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THE
AMERICAN EPHEMERIS
AND
NAUTICAL ALMANAC

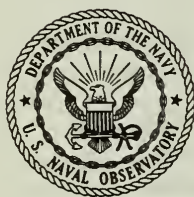
FOR THE YEAR 1960

WASHINGTON

Issued by the
Nautical Almanac Office
United States
Naval Observatory
by direction of the
Secretary of the Navy
and under the
authority of Congress

LONDON

Issued by
Her Majesty's
Nautical Almanac Office
by order of the
Lords Commissioners
of the Admiralty
under the title
The Astronomical Ephemeris



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1958

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1960
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U. S. NAVAL OBSERVATORY

Commander W. M. ROBINSON, *U. S. N., Acting Superintendent*

ASTRONOMICAL COUNCIL

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GERTRUDE L. JOHNSON

PREFACE

Beginning with the editions for 1960, *The American Ephemeris and Nautical Almanac* issued by the Nautical Almanac Office, United States Naval Observatory, and *The Astronomical Ephemeris* issued by H.M. Nautical Almanac Office, Royal Greenwich Observatory, are now unified. With the exception of the introductory pages i, ii, vi, and viii the two publications are identical; they are printed separately in the two countries, from reproducible material prepared partly in the United States of America and partly in the United Kingdom.

The title *The Astronomical Ephemeris* replaces, without loss of continuity of content, the previous title of *The Nautical Almanac and Astronomical Ephemeris* (usually abbreviated to the *Nautical Almanac*), which was introduced by Nevil Maskelyne for the original British edition of 1767; the title *The Nautical Almanac* will henceforward be used, in both the United Kingdom and the United States, for the unified edition of the Almanac for surface navigation previously entitled *The Abridged Nautical Almanac* and *The American Nautical Almanac* respectively.

The unification has not required any substantial changes in either publication; but a number of revisions have been made to increase the precision and improve the usefulness. The contents are fully described in the *Explanation* at the end of the volume. The principal changes from the immediately preceding volumes are for the purpose of conforming to the recommendations of the Paris Conference on Astronomical Constants in 1950 and to the resolutions of the International Astronomical Union at the Zürich Assembly in 1948, the Rome Assembly in 1952, and the Dublin Assembly in 1955.

In accordance with these resolutions, the designation Ephemeris Time is adopted for the argument of the fundamental ephemerides of the Sun, Moon, and planets. In nearly all the other ephemerides, the argument is Universal Time, obtained from an extrapolated value of the difference between the two measures of time. The longitude, latitude, and parallax of the Moon are calculated directly from theoretical expressions derived by amending Brown's expressions in order to obtain a strictly gravitational ephemeris expressed in the same measure of time as defined by Newcomb's *Tables of the Sun*, and by including aberration; the coordinates of the Moon are tabulated to one more decimal than in preceding volumes. The ephemerides of Jupiter, Saturn, Uranus, Neptune, and Pluto are calculated from rectangular heliocentric coordinates obtained by numerical integration; and the geocentric right ascensions and declinations are tabulated to one more decimal than in preceding volumes. In the ephemeris for physical observations of Mars, the period of rotation determined by Ashbrook is adopted. The ephemeris of the fifth satellite of Jupiter is computed from the orbital elements determined by van Woerkom.

The nutation in longitude and obliquity is calculated from the expressions obtained by retaining all terms with coefficients as great as $0''.0002$ in the developments derived by Woolard; and in the ephemerides of the Sun, Moon, and planets, the short-period terms of nutation, defined as terms with periods of less than 100 days, are fully included in all the tabular quantities. The Day Numbers for the calculation of apparent places of stars are for reductions from the mean place at the *nearest* beginning of a year, instead of always at the beginning of the

current year. The Day Number A is re-defined, as the product of the former value by the annual precession in declination, in order to express it in seconds of arc; and the Day Numbers C and D are computed from the actual disturbed velocity of the Earth referred to the centre of mass of the solar system. The Day Numbers are tabulated to one more decimal than in preceding volumes.

These fundamental revisions are accompanied by many changes in the details of form and arrangement from the immediately preceding volumes, and by some additions and omissions. The principal omissions from the *American Ephemeris* are: the elements and predictions of occultations; the local circumstances of solar eclipses and of the transit of Mercury; the former list of mean places of 1551 standard stars; the Day Numbers for Greenwich sidereal 12^h without short-period terms; and the former tables relating to *Polaris*. Omissions from the former *Nautical Almanac* are: the ephemerides of the Sun, Moon, and planets at transit at Greenwich; the apparent places of occulted stars and predictions of occultations; and the daily times of sunrise and sunset.

The additions are: Day Numbers, denoted by J and J' , for calculating apparent places of stars to the second order; predictions of penumbral lunar eclipses when any occur; an ephemeris for physical observations of Saturn; and a list of radio observatories. The tables from the former *Nautical Almanac* for approximate reductions of positions from the mean equinox of 1950.0 to the true equinox of date, and for differential aberration, precession, and nutation, not previously included in the *American Ephemeris*, have been retained.

Precise transit ephemerides, which have not been printed in the *American Ephemeris* since 1950, are not required for finding purposes, nor for the comparison of observation with theory; the transit ephemerides that may be necessary for setting meridian instruments, and for reduction of the observations, may readily be computed as needed where observations are made.

Instead of the list of mean places of stars omitted from the *American Ephemeris*, the shorter list, with less precise positions, from the former *Nautical Almanac* is retained; and in place of the omitted *Polaris* tables, a single table for determining latitude and azimuth from *Polaris*, formerly Table XIV in the *Nautical Almanac*, is included.

In place of the omitted local circumstances of solar eclipses, the eclipse maps are on a larger scale when needed. An adequate map is likewise included for the transit of Mercury. The representations of the configurations of the four principal satellites of Jupiter, which were previously given for particular times, differing in the two countries, have been replaced by a series of diagrams enabling the positions to be estimated at any time.

Although no data are now included in respect of occultations of stars by the Moon, the occultation programme of H. M. Nautical Almanac Office continues unchanged. Arrangements for the publication of predictions have been made as follows: for stations in the United States and Canada in *Sky and Telescope*; and for other British stations in the *Handbook of the British Astronomical Association*. Machine copies of predictions for any of the 70 stations for which predictions are made, or of the elements of occultations, may be obtained on request.

The apparent places of the 1535 stars in the FK3 are available in *Apparent Places of Fundamental Stars*, published annually under the auspices of the International Astronomical Union, as from 1960 by the Astronomisches Rechen-Institut

in Heidelberg. The apparent places are tabulated continuously at intervals of ten upper transits at Greenwich; and the mean places will be listed in at least every tenth annual volume. Each volume also contains, for purposes of record, the Besselian Day Numbers at 12^h Greenwich sidereal time, without short-period terms, with which the apparent places are calculated.

The star ephemerides that are needed by surveyors, including the tables relating to *Polaris*, are available in *The Ephemeris* published by the U.S. Bureau of Land Management, and in *The Star Almanac for Land Surveyors* prepared by H. M. Nautical Almanac Office and published by H. M. Stationery Office.

An *Explanatory Supplement* to this volume, to be published by H. M. Stationery Office in London, is in course of preparation, but is unlikely to be available before July 1959. This will contain detailed explanations of the data included in this volume, together with a derivation and numerical illustrations, as well as useful permanent tables that are now omitted.

By international agreement, the basic calculations for this volume, and for other astronomical ephemerides such as *Apparent Places of Fundamental Stars*, and *Ephemerides of Minor Planets*, are shared between the ephemeris offices of a number of countries. Contributions, in addition to those listed below, are made by the Astronomisches Rechen-Institut in Heidelberg, the Institute for Theoretical Astronomy in Leningrad, and the offices of the *Connaissance des Temps* in Paris and the *Almanaque Nautico* in San Fernando.

The ephemeris of Universal and Sidereal Times, the ephemerides of the Sun, Moon, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune, the geocentric ephemerides of Ceres, Pallas, Juno, Vesta, and Pluto, the nutation in longitude and obliquity, the Day Numbers, and the Phenomena, are prepared in H. M. Nautical Almanac Office.

The conjunctions, phenomena, and configurations of Satellites I–IV of Jupiter are received from the office of the *Connaissance des Temps*. The data for Table II are received from the Astronomisches Rechen-Institut.

The remaining data in the volume are prepared in the Nautical Almanac Office, United States Naval Observatory, namely: mean places of stars; eclipses of the Sun and Moon, and transit of Mercury; ephemerides for physical observations of the Sun, Moon, and planets; ephemerides of the satellites of Mars, Saturn, Uranus, and Neptune, and of Satellites V, VI, and VII of Jupiter, and of the rings of Saturn; local mean times of moonrise and moonset; Tables III, IV, and VI.

This volume was prepared jointly by H. M. Nautical Almanac Office, Royal Greenwich Observatory, under the immediate supervision of D. H. Sadler, and by the Nautical Almanac Office, United States Naval Observatory, under the immediate supervision of G. M. Clemence and Edgar W. Woolard.

W. M. ROBINSON,
Commander U. S. Navy,
Acting Superintendent, Naval Observatory,
Washington.

R. v.d. R. WOOLLEY,
Astronomer Royal,
Royal Greenwich Observatory,
Herstmonceux Castle, Sussex.

November, 1957

The calculations for the principal ephemerides prepared in the Nautical Almanac Office, United States Naval Observatory, were made by the following members of the staff and their assistants: mean places of stars, MARIAN H. SHARPLESS; eclipses of the Sun and the Moon, and the transit of Mercury, SIMONE DARO GOSSNER; ephemerides for physical observations of the Sun, Moon, and planets, and ephemerides of the satellites of Mars, Saturn, Uranus, and Neptune, satellites VI and VII of Jupiter, and the rings of Saturn, CHARLOTTE KRAMPE; local mean time of moonrise and moonset, RALPH F. HAUPT. The maps of solar eclipses and the transit of Mercury, and the diagrams of the satellite orbits and the configurations of satellites I-IV of Jupiter, were prepared by SIMONE DARO GOSSNER. The interpolation tables, Tables XIII-XVII, were designed by G. A. WILKINS.

ΔT

REDUCTION FROM UNIVERSAL TIME TO EPHEMERIS TIME

Add to Universal Time

	s	d		s	d		s	d
1901.5	- 2.54	-.000029	1921.5	+21.06	+.000244	1941.5	+24.71	+.000286
1902.5	- 1.13	-.000013	1922.5	21.56	.000250	1942.5	25.15	.000291
1903.5	+ 0.35	+.000004	1923.5	21.97	.000254	1943.5	25.61	.000296
1904.5	1.80	.000021	1924.5	22.29	.000258	1944.5	26.08	.000302
1905.5	3.26	.000038	1925.5	22.55	.000261	1945.5	26.57	.000308
1906.5	+ 4.69	+.000054	1926.5	+22.72	+.000263	1946.5	+27.08	+.000313
1907.5	6.11	.000071	1927.5	22.82	.000264	1947.5	27.61	.000320
1908.5	7.51	.000087	1928.5	22.92	.000265	1948.5	28.15	.000326
1909.5	8.90	.000103	1929.5	23.05	.000267	1949.5	28.94	.000335
1910.5	10.28	.000119	1930.5	23.18	.000268	1950.5	29.42	.000341
1911.5	+11.64	+.000135	1931.5	+23.34	+.000270	1951.5	+29.59	+.000342
1912.5	12.95	.000150	1932.5	23.50	.000272	1952.5	30.21	.000350
1913.5	14.18	.000164	1933.5	23.60	.000273	1953.5	30.8	.00036
1914.5	15.31	.000177	1934.5	23.64	.000274	1954.5	31.0	.00036
1915.5	16.39	.000190	1935.5	23.63	.000273	1955.5	31.5	.00036
1916.5	+17.37	+.000201	1936.5	+23.58	+.000273	1956.5	+32	. . .
1917.5	18.27	.000211	1937.5	23.63	.000273	1957.5	33	. . .
1918.5	19.08	.000221	1938.5	23.76	.000275	1958.5	33	. . .
1919.5	19.83	.000230	1939.5	23.99	.000278	1959.5	34	. . .
1920.5	+20.48	+.000237	1940.5	+24.30	+.000281	1960.5	+35	. . .

Where values are given to 0th, they are based on incomplete observational data; those that are given to whole seconds are extrapolated. These values will usually prove to be correct; but the end figure may later be revised on the basis of further observational data.

The values previous to 1949.5 are those of BROUWER, *Astronomical Journal*, 57, 133, 1952; his table of ΔT extends over most of the 19th century.

CIVIL CALENDAR

New Year's Day	Fri.	Jan. 1	Labor Day	Mon.	Sept. 5
Lincoln's Birthday	Fri.	Feb. 12	Columbus Day	Wed.	Oct. 12
Washington's Birthday	Mon.	Feb. 22	General Election Day	Tues.	Nov. 8
Memorial Day	Mon.	May 30	Veterans Day	Fri.	Nov. 11
Independence Day	Mon.	July 4	Thanksgiving Day	Thu.	Nov. 24

ERRATA

The American Ephemeris, 1959

Page

501 Third line from top, ΔZ for + 244 read - 244*The American Ephemeris, 1960*

- 177 The elements of the outer planets have been calculated using the Gaussian constant k instead of $k \sqrt{1+m}$; corrected values are given on page xii.
- 210-235 Small corrections to the printed ephemerides of the planets are given on page ix.
- 286, 287 The second-order day numbers on these pages apply to northern declinations only. Values for southern declinations are given on pages x and xi.

In interpolating the geometric ephemerides of the planets for light-time, in order to correct for aberration, the second-difference correction in Stirling's formula was applied erroneously. The following corrections are to be applied to the printed ephemerides.

Date	SATURN		URANUS		NEPTUNE		PLUTO	
	α	δ	α	δ	α	δ	α	δ
	^s 0.001	["] 0.01	^s 0.001	["] 0.01	^s 0.001	["] 0.01	^s 0.001	["] 0.01
Jan. -3	0	0	-1	0	-2	+1	-1	0
7	0	0	-1	0	-2	+1	-1	0
17	0	0	-1	0	-2	+1	-1	0
27	0	0	0	0	-2	+1	0	-1
Feb. 6	0	0	0	0	-2	+1	0	-1
16	0	0	0	0	-2	+1	0	-1
26	0	0	0	0	-2	+1	+1	-1
Mar. 7	0	0	+1	0	-2	+1	+1	-2
17	0	0	+1	0	-1	+1	+2	-2
27	-1	0	+1	0	-1	0	+2	-2
Apr. 6	-1	0	+1	-1	-1	0	+2	-1
16	-1	0	+1	-1	0	0	+3	-1
26	-1	0	+1	-1	0	0	+3	-1
May 6	-1	0	+1	-1	0	0	+3	-1
16	-1	0	+1	-1	+1	0	+3	-1
26	0	0	+1	0	+1	-1	+2	-1
June 5	0	0	+1	0	+1	-1	+2	0
15	0	0	+1	0	+1	-1	+2	0
25	0	0	+1	0	+2	-1	+1	0
July 5	0	0	+1	0	+2	-1	+1	0
15	0	0	0	0	+2	-1	+1	0
25	0	0	0	0	+2	-1	+1	+1
Aug. 4	0	0	0	0	+2	-1	0	+1
14	0	0	0	0	+2	-1	0	+1
24	+1	0	0	0	+2	-1	0	+1
Sept. 3	+1	0	0	0	+1	-1	-1	+1
13	+1	0	0	0	+1	-1	-1	+1
23	+1	0	-1	0	+1	0	-2	+1
Oct. 3	+1	0	-1	0	+1	0	-2	+2
13	+1	0	-1	0	+1	0	-2	+2
23	+1	0	-1	+1	0	0	-2	+2
Nov. 2	0	0	-1	+1	0	0	-3	+1
12	0	0	-1	+1	0	0	-3	+1
22	0	0	-1	+1	-1	0	-3	+1
Dec. 2	0	0	-1	+1	-1	0	-2	+1
12	0	0	-1	+1	-1	+1	-2	+1
22	0	0	-1	+1	-1	+1	-2	0
32	0	0	-1	0	-2	+1	-2	0

The corrections for Jupiter are always less than one unit.

SECOND-ORDER DAY NUMBER J , 1960

FOR SOUTHERN DECLINATIONS

FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J (0 ^s .00001)														
Jan.	-3	- 8	- 4	0	+ 5	+ 8	+ 9	+ 8	+ 4	0	- 5	- 8	- 9	- 8
	7	- 9	- 7	- 2	+ 3	+ 7	+ 9	+ 9	+ 7	+ 2	- 3	- 7	- 9	- 9
	17	-10	- 9	- 5	0	+ 5	+ 9	+10	+ 9	+ 5	0	- 5	- 9	-10
	27	-10	-10	- 8	- 3	+ 2	+ 7	+10	+10	+ 8	+ 3	- 2	- 7	-10
Feb.	6	- 9	-11	-10	- 6	- 1	+ 5	+ 9	+11	+10	+ 6	+ 1	- 5	- 9
	16	- 7	-10	-11	- 9	- 4	+ 2	+ 7	+10	+11	+ 9	+ 4	- 2	- 7
	26	- 4	- 9	-11	-11	- 7	- 1	+ 4	+ 9	+11	+11	+ 7	+ 1	- 4
Mar.	7	- 1	- 7	-11	-12	-10	- 5	+ 1	+ 7	+11	+12	+10	+ 5	- 1
	17	+ 2	- 4	- 9	-12	-11	- 8	- 2	+ 4	+ 9	+12	+11	+ 8	+ 2
	27	+ 5	- 1	- 7	-11	-13	-10	- 5	+ 1	+ 7	+11	+13	+10	+ 5
Apr.	6	+ 9	+ 2	- 4	-10	-13	-13	- 9	- 2	+ 4	+10	+13	+13	+ 9
	16	+11	+ 6	- 1	- 8	-12	-14	-11	- 6	+ 1	+ 8	+12	+14	+11
	26	+13	+ 9	+ 2	- 5	-11	-14	-13	- 9	- 2	+ 5	+11	+14	+13
May	6	+14	+12	+ 6	- 2	- 9	-13	-14	-12	- 6	+ 2	+ 9	+13	+14
	16	+15	+14	+ 9	+ 2	- 6	-12	-15	-14	- 9	- 2	+ 6	+12	+15
	26	+14	+15	+11	+ 5	- 3	-10	-14	-15	-11	- 5	+ 3	+10	+14
June	5	+13	+15	+13	+ 8	+ 1	- 7	-13	-15	-13	- 8	- 1	+ 7	+13
	15	+11	+14	+14	+11	+ 4	- 4	-11	-14	-14	-11	- 4	+ 4	+11
	25	+ 8	+13	+15	+12	+ 7	- 1	- 8	-13	-15	-12	- 7	+ 1	+ 8
July	5	+ 5	+11	+14	+13	+ 9	+ 2	- 5	-11	-14	-13	- 9	- 2	+ 5
June	25	+ 2	+ 2	+ 1	0	- 1	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2
July	5	+ 2	+ 1	+ 1	+ 1	0	- 1	- 2	- 1	- 1	- 1	0	+ 1	+ 2
	15	+ 1	+ 1	+ 1	+ 1	+ 1	0	- 1	- 1	- 1	- 1	- 1	0	+ 1
	25	0	0	+ 1	+ 1	+ 1	+ 1	0	0	- 1	- 1	- 1	- 1	0
Aug.	4	- 1	0	0	0	+ 1	+ 1	+ 1	0	0	0	- 1	- 1	- 1
	14	- 1	- 1	- 1	0	0	+ 1	+ 1	+ 1	+ 1	0	0	- 1	- 1
	24	0	- 1	- 1	- 1	- 1	0	0	+ 1	+ 1	+ 1	+ 1	0	0
Sept.	3	0	0	- 1	- 1	- 1	- 1	0	0	+ 1	+ 1	+ 1	+ 1	0
	13	+ 1	+ 1	0	- 1	- 2	- 2	- 1	- 1	0	+ 1	+ 2	+ 2	+ 1
	23	+ 2	+ 2	0	- 1	- 2	- 3	- 2	- 2	0	+ 1	+ 2	+ 3	+ 2
Oct.	3	+ 3	+ 3	+ 2	0	- 2	- 3	- 3	- 3	- 2	0	+ 2	+ 3	+ 3
	13	+ 4	+ 4	+ 3	+ 2	- 1	- 3	- 4	- 4	- 3	- 2	+ 1	+ 3	+ 4
	23	+ 4	+ 5	+ 5	+ 4	+ 1	- 2	- 4	- 5	- 5	- 4	- 1	+ 2	+ 4
Nov.	2	+ 4	+ 6	+ 6	+ 5	+ 3	0	- 4	- 6	- 6	- 5	- 3	0	+ 4
	12	+ 2	+ 5	+ 7	+ 7	+ 5	+ 1	- 2	- 5	- 7	- 7	- 5	- 1	+ 2
	22	0	+ 4	+ 7	+ 8	+ 7	+ 4	0	- 4	- 7	- 8	- 7	- 4	0
Dec.	2	- 2	+ 3	+ 7	+ 9	+ 9	+ 6	+ 2	- 3	- 7	- 9	- 9	- 6	- 2
	12	- 5	0	+ 5	+ 9	+10	+ 8	+ 5	0	- 5	- 9	-10	- 8	- 5
	22	- 7	- 2	+ 3	+ 7	+10	+10	+ 7	+ 2	- 3	- 7	-10	-10	- 7
	32	- 9	- 5	0	+ 6	+ 9	+11	+ 9	+ 5	0	- 6	- 9	-11	- 9

The quantity J is given in this table in units of 0^s.00001, and is to be multiplied by $\tan^2 \delta$ to give the second-order correction in the calculation of the apparent right ascension of a star.

The complete formula is :

$$a = a_0 + \tau \mu_a + Aa + Bb + Cc + Dd + E + J \tan^2 \delta$$

FOR SOUTHERN DECLINATIONS

FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J' (0".0001)														
Jan.	-3	- 3	- 1	0	- 1	- 4	- 7	-10	-13	-14	-13	-10	- 7	- 3
	7	- 5	- 2	0	0	- 2	- 5	- 9	-12	-14	-14	-12	- 9	- 5
	17	- 8	- 4	- 1	0	- 1	- 4	- 7	-11	-14	-15	-14	-11	- 8
	27	-10	- 6	- 3	0	0	- 2	- 5	- 9	-13	-15	-16	-14	-10
Feb.	6	-13	- 9	- 5	- 1	0	- 1	- 4	- 8	-12	-15	-16	-16	-13
	16	-15	-11	- 7	- 3	- 1	0	- 2	- 5	-10	-14	-16	-16	-15
	26	-17	-14	-10	- 5	- 2	0	- 1	- 3	- 8	-12	-15	-17	-17
Mar.	7	-18	-16	-12	- 8	- 4	- 1	0	- 2	- 5	-10	-14	-17	-18
	17	-18	-18	-15	-11	- 6	- 2	0	- 1	- 3	- 8	-12	-16	-18
	27	-18	-19	-17	-14	- 9	- 4	- 1	0	- 2	- 5	-10	-15	-18
Apr.	6	-17	-20	-19	-16	-12	- 7	- 2	0	- 1	- 3	- 8	-13	-17
	16	-16	-20	-21	-19	-15	- 9	- 4	- 1	0	- 2	- 6	-11	-16
	26	-14	-19	-21	-21	-17	-12	- 7	- 2	0	- 1	- 4	- 9	-14
May	6	-12	-17	-21	-22	-20	-15	-10	- 4	- 1	0	- 2	- 6	-12
	16	-10	-16	-20	-22	-22	-18	-13	- 7	- 2	0	- 1	- 4	-10
	26	- 8	-13	-19	-22	-22	-20	-15	- 9	- 4	- 1	0	- 3	- 8
June	5	- 5	-11	-16	-21	-23	-21	-17	-12	- 6	- 2	0	- 1	- 5
	15	- 3	- 8	-14	-19	-22	-22	-19	-14	- 8	- 3	0	0	- 3
	25	- 2	- 6	-12	-17	-21	-22	-20	-16	-10	- 5	- 1	0	- 2
July	5	- 1	- 4	- 9	-14	-19	-21	-20	-17	-12	- 7	- 2	0	- 1
June	25	- 2	- 3	- 3	- 4	- 3	- 3	- 2	- 1	0	0	0	- 1	- 2
July	5	- 1	- 1	- 2	- 2	- 3	- 2	- 2	- 1	- 1	0	0	0	- 1
	15	0	0	- 1	- 1	- 2	- 2	- 2	- 1	- 1	0	0	0	0
	25	0	0	0	- 1	- 1	- 1	- 1	- 1	- 1	- 1	0	0	0
Aug.	4	0	0	0	0	0	- 1	- 1	- 1	- 1	- 1	- 1	- 1	0
	14	- 1	0	0	0	0	0	0	- 1	- 1	- 1	- 1	- 1	- 1
	24	- 1	- 1	- 1	0	0	0	0	0	- 1	- 1	- 1	- 2	- 1
Sept.	3	- 2	- 2	- 2	- 1	- 1	0	0	0	0	- 1	- 1	- 2	- 2
	13	- 2	- 3	- 3	- 2	- 2	- 1	0	0	0	0	- 1	- 2	- 2
	23	- 3	- 3	- 4	- 4	- 3	- 2	- 1	0	0	0	- 1	- 2	- 3
Oct.	3	- 2	- 4	- 5	- 5	- 5	- 4	- 3	- 1	0	0	0	- 1	- 2
	13	- 2	- 4	- 5	- 6	- 7	- 6	- 4	- 3	- 1	0	0	- 1	- 2
	23	- 1	- 3	- 5	- 7	- 8	- 8	- 7	- 5	- 3	- 1	0	0	- 1
Nov.	2	- 1	- 3	- 5	- 7	- 9	-10	- 9	- 7	- 4	- 2	0	0	- 1
	12	0	- 2	- 4	- 7	-10	-11	-11	- 9	- 7	- 4	- 1	0	0
	22	0	- 1	- 3	- 6	- 9	-12	-12	-12	- 9	- 6	- 3	- 1	0
Dec.	2	0	0	- 2	- 5	- 9	-12	-13	-13	-12	- 8	- 5	- 2	0
	12	- 1	0	- 1	- 4	- 8	-11	-14	-15	-14	-11	- 7	- 3	- 1
	22	- 2	0	0	- 2	- 6	-10	-13	-15	-15	-13	- 9	- 5	- 2
	32	- 4	- 1	0	- 1	- 4	- 8	-12	-15	-16	-15	-12	- 8	- 4

The quantity J' is given in this table in units of 0".0001, and is to be multiplied by $\tan \delta$ to give the second-order correction in the calculation of the apparent declination of a star.

The complete formula is :

$$\delta = \delta_0 + \tau\mu_\delta + Aa' + Bb' + Cc' + Dd' + J' \tan \delta$$

OUTER PLANETS, 1960

OSCULATING ELEMENTS

MEAN EQUINOX AND ECLIPTIC OF DA

Date	Julian Date	Inclination <i>i</i>	Longitude of Asc. Node | Perihelion Ω | ϖ		Mean Distance <i>a</i>	Mean Motion <i>n</i>
JUPITER						
	243	°	°	°		°
Jan. 27	6960.5	1.30641	100.0560	13.3426	5.203 260	0.083 0803
Mar. 7	7000.5	1.30639	100.0571	13.3290	.203 343	.083 0783
Apr. 16	7040.5	1.30637	100.0582	13.3153	.203 425	.083 0764
May 26	7080.5	1.30636	100.0593	13.3018	.203 503	.083 0745
July 5	7120.5	1.30634	100.0604	13.2887	.203 577	.083 0727
Aug. 14	7160.5	1.30632	100.0614	13.2763	5.203 645	0.083 0711
Sept. 23	7200.5	1.30631	100.0623	13.2649	.203 705	.083 0696
Nov. 2	7240.5	1.30629	100.0633	13.2548	.203 756	.083 0684
Dec. 12	7280.5	1.30627	100.0642	13.2462	5.203 796	0.083 0674
SATURN						
Jan. 27	6960.5	2.48722	113.3161	92.1486	9.580 114	0.033 2437
Mar. 7	7000.5	2.48721	113.3174	92.0053	.580 195	.033 2433
Apr. 16	7040.5	2.48720	113.3187	91.8580	.580 252	.033 2430
May 26	7080.5	2.48719	113.3199	91.7069	.580 289	.033 2428
July 5	7120.5	2.48718	113.3212	91.5524	.580 312	.033 2427
Aug. 14	7160.5	2.48718	113.3224	91.3948	9.580 326	0.033 2427
Sept. 23	7200.5	2.48718	113.3236	91.2345	.580 337	.033 2426
Nov. 2	7240.5	2.48718	113.3248	91.0719	.580 350	.033 2425
Dec. 12	7280.5	2.48718	113.3261	90.9076	9.580 369	0.033 2424
URANUS						
Jan. 27	6960.5	0.77236	73.7218	172.5607	19.16215	0.011 7502
Mar. 7	7000.5	0.77234	73.7183	172.6343	.15840	.011 7537
Apr. 16	7040.5	0.77232	73.7149	172.6991	.15473	.011 7571
May 26	7080.5	0.77230	73.7117	172.7548	.15115	.011 7604
July 5	7120.5	0.77228	73.7088	172.8010	.14767	.011 7636
Aug. 14	7160.5	0.77227	73.7060	172.8375	19.14429	0.011 7667
Sept. 23	7200.5	0.77225	73.7034	172.8640	.14103	.011 7697
Nov. 2	7240.5	0.77224	73.7010	172.8802	.13789	.011 7726
Dec. 12	7280.5	0.77223	73.6989	172.8859	19.13488	0.011 7754
NEPTUNE						
Jan. 27	6960.5	1.77329	131.3233	26.1193	30.23647	0.005 9281
Mar. 7	7000.5	1.77329	131.3285	24.9429	.23088	.005 9298
Apr. 16	7040.5	1.77328	131.3337	24.0217	.22496	.005 9315

CALENDAR, 1960

CHRONOLOGICAL CYCLES AND ERAS

Dominical Letter	...	...	C, B	Julian Period (year of)
Epact	...	...	...	Roman Indiction
Golden Number (Lunar Cycle)			IV	Solar Cycle

All dates are given in terms of the Gregorian calendar.

January 14 corresponds to 1960 January 1, Julian calendar.

Julian Day 243 6935 begins at Greenwich mean noon on Jan

ERA	YEAR	BEGINS	ERA
Byzantine	7469	Sept. 14	Grecian (Seleucidæ)
Jewish (A. M.)	5721	„ 22	
Roman (A. U. C.)	2713	Jan. 14	Indian (Saka)
Nabonassar	2709	May 4	Diocletian
Japanese (35th year of Showa)	2620	Jan. 1	Mohammedan (A. H.) (Hegira)

RELIGIOUS CALENDARS

Epiphany	...	...	Jan. 6	Rogation Sunday
Septuagesima Sunday	...	Feb. 14		Ascension Day— Holy Thursday
Quinquagesima (Shrove) Sunday	...	...	„ 28	Whit Sunday—Pentecost
Ash Wednesday	...	Mar. 2		Trinity Sunday
Palm Sunday	...	Apr. 10		Corpus Christi
Good Friday	...	„ 15		First Sunday in Advent
Easter Day	...	„ 17		Christmas Day (Sun)

First day of Passover ... Apr. 12 Day of Atonement

Day of Month	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date
1.0	F.	2436 934.5	M.	2436 965.5	Tu.	2436 994.5	F.	2437 025.5	§.	2437 055.5	W.	2437 086.5
2.0	S.	935.5	Tu.	966.5	W.	995.5	S.	026.5	M.	056.5	Th.	087.5
3.0	§.	936.5	W.	967.5	Th.	996.5	§.	027.5	Tu.	057.5	F.	088.5
4.0	M.	937.5	Th.	968.5	F.	997.5	M.	028.5	W.	058.5	S.	089.5
5.0	Tu.	938.5	F.	969.5	S.	998.5	Tu.	029.5	Th.	059.5	§.	090.5
6.0	W.	939.5	S.	970.5	§.	999.5	W.	030.5	F.	060.5	M.	091.5
7.0	Th.	940.5	§.	971.5	M.	*000.5	Th.	031.5	S.	061.5	Tu.	092.5
8.0	F.	941.5	M.	972.5	Tu.	*001.5	F.	032.5	§.	062.5	W.	093.5
9.0	S.	942.5	Tu.	973.5	W.	*002.5	S.	033.5	M.	063.5	Th.	094.5
10.0	§.	943.5	W.	974.5	Th.	*003.5	§.	034.5	Tu.	064.5	F.	095.5
11.0	M.	944.5	Th.	975.5	F.	*004.5	M.	035.5	W.	065.5	S.	096.5
12.0	Tu.	945.5	F.	976.5	S.	*005.5	Tu.	036.5	Th.	066.5	§.	097.5
13.0	W.	946.5	S.	977.5	§.	*006.5	W.	037.5	F.	067.5	M.	098.5
14.0	Th.	947.5	§.	978.5	M.	*007.5	Th.	038.5	S.	068.5	Tu.	099.5
15.0	F.	948.5	M.	979.5	Tu.	*008.5	F.	039.5	§.	069.5	W.	100.5
16.0	S.	949.5	Tu.	980.5	W.	*009.5	S.	040.5	M.	070.5	Th.	101.5
17.0	§.	950.5	W.	981.5	Th.	*010.5	§.	041.5	Tu.	071.5	F.	102.5
18.0	M.	951.5	Th.	982.5	F.	*011.5	M.	042.5	W.	072.5	S.	103.5
19.0	Tu.	952.5	F.	983.5	S.	*012.5	Tu.	043.5	Th.	073.5	§.	104.5
20.0	W.	953.5	S.	984.5	§.	*013.5	W.	044.5	F.	074.5	M.	105.5
21.0	Th.	954.5	§.	985.5	M.	*014.5	Th.	045.5	S.	075.5	Tu.	106.5
22.0	F.	955.5	M.	986.5	Tu.	*015.5	F.	046.5	§.	076.5	W.	107.5
23.0	S.	956.5	Tu.	987.5	W.	*016.5	S.	047.5	M.	077.5	Th.	108.5
24.0	§.	957.5	W.	988.5	Th.	*017.5	§.	048.5	Tu.	078.5	F.	109.5
25.0	M.	958.5	Th.	989.5	F.	*018.5	M.	049.5	W.	079.5	S.	110.5
26.0	Tu.	959.5	F.	990.5	S.	*019.5	Tu.	050.5	Th.	080.5	§.	111.5
27.0	W.	960.5	S.	991.5	§.	*020.5	W.	051.5	F.	081.5	M.	112.5
28.0	Th.	961.5	§.	992.5	M.	*021.5	Th.	052.5	S.	082.5	Tu.	113.5
29.0	F.	962.5	M.	993.5	Tu.	*022.5	F.	053.5	§.	083.5	W.	114.5
30.0	S.	963.5			W.	*023.5	S.	054.5	M.	084.5	Th.	115.5
31.0	§.	964.5			Th.	*024.5			Tu.	085.5		

The Julian Day begins at noon.

The fraction of the year τ , measured from the beginning of the Besselian fictitious year (1960.0 or 1960 January 1^d.345), is given on pages 266–280.

Day of Month	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date
1-0	F.	2437 116.5	M.	2437 147.5	Th.	2437 178.5	S.	2437 208.5	Tu.	2437 239.5	Th.	2437 269.5
2-0	S.	117.5	Tu.	148.5	F.	179.5	♄.	209.5	W.	240.5	F.	270.5
3-0	♄.	118.5	W.	149.5	S.	180.5	M.	210.5	Th.	241.5	S.	271.5
4-0	M.	119.5	Th.	150.5	♄.	181.5	Tu.	211.5	F.	242.5	♄.	272.5
5-0	Tu.	120.5	F.	151.5	M.	182.5	W.	212.5	S.	243.5	M.	273.5
6-0	W.	121.5	S.	152.5	Tu.	183.5	Th.	213.5	♄.	244.5	Tu.	274.5
7-0	Th.	122.5	♄.	153.5	W.	184.5	F.	214.5	M.	245.5	W.	275.5
8-0	F.	123.5	M.	154.5	Th.	185.5	S.	215.5	Tu.	246.5	Th.	276.5
9-0	S.	124.5	Tu.	155.5	F.	186.5	♄.	216.5	W.	247.5	F.	277.5
10-0	♄.	125.5	W.	156.5	S.	187.5	M.	217.5	Th.	248.5	S.	278.5
11-0	M.	126.5	Th.	157.5	♄.	188.5	Tu.	218.5	F.	249.5	♄.	279.5
12-0	Tu.	127.5	F.	158.5	M.	189.5	W.	219.5	S.	250.5	M.	280.5
13-0	W.	128.5	S.	159.5	Tu.	190.5	Th.	220.5	♄.	251.5	Tu.	281.5
14-0	Th.	129.5	♄.	160.5	W.	191.5	F.	221.5	M.	252.5	W.	282.5
15-0	F.	130.5	M.	161.5	Th.	192.5	S.	222.5	Tu.	253.5	Th.	283.5
16-0	S.	131.5	Tu.	162.5	F.	193.5	♄.	223.5	W.	254.5	F.	284.5
17-0	♄.	132.5	W.	163.5	S.	194.5	M.	224.5	Th.	255.5	S.	285.5
18-0	M.	133.5	Th.	164.5	♄.	195.5	Tu.	225.5	F.	256.5	♄.	286.5
19-0	Tu.	134.5	F.	165.5	M.	196.5	W.	226.5	S.	257.5	M.	287.5
20-0	W.	135.5	S.	166.5	Tu.	197.5	Th.	227.5	♄.	258.5	Tu.	288.5
21-0	Th.	136.5	♄.	167.5	W.	198.5	F.	228.5	M.	259.5	W.	289.5
22-0	F.	137.5	M.	168.5	Th.	199.5	S.	229.5	Tu.	260.5	Th.	290.5
23-0	S.	138.5	Tu.	169.5	F.	200.5	♄.	230.5	W.	261.5	F.	291.5
24-0	♄.	139.5	W.	170.5	S.	201.5	M.	231.5	Th.	262.5	S.	292.5
25-0	M.	140.5	Th.	171.5	♄.	202.5	Tu.	232.5	F.	263.5	♄.	293.5
26-0	Tu.	141.5	F.	172.5	M.	203.5	W.	233.5	S.	264.5	M.	294.5
27-0	W.	142.5	S.	173.5	Tu.	204.5	Th.	234.5	♄.	265.5	Tu.	295.5
28-0	Th.	143.5	♄.	174.5	W.	205.5	F.	235.5	M.	266.5	W.	296.5
29-0	F.	144.5	M.	175.5	Th.	206.5	S.	236.5	Tu.	267.5	Th.	297.5
30-0	S.	145.5	Tu.	176.5	F.	207.5	♄.	237.5	W.	268.5	F.	298.5
31-0	♄.	146.5	W.	177.5			M.	238.5			S.	299.5

The Julian Day begins at noon.

The fraction of the year τ , measured from the beginning of the Besselian fictitious year (1960.0 or 1960 January 1^d.345), is given on pages 266–280.

PHENOMENA, 1960

GEOCENTRIC PHENOMENA IN U.T.

MERCURY

Superior conjunction ...	Jan. 26	May 17	Aug. 30
Greatest elongation East	Feb. 23 (18°)	June 19 (25°)	Oct. 15 (25°)
Stationary	Mar. 1	July 2	Oct. 27
Inferior conjunction ...	Mar. 10	July 17	Nov. 7
Stationary	Mar. 23	July 27	Nov. 16
Greatest elongation West	Apr. 7 (28°)	Aug. 5 (19°)	Nov. 24 (20°)

VENUS

Superior conjunction ... June 22

EARTH

Perihelion ...	Jan. 4	Equinoxes ...	Mar. 20 ^d 14 ^h 43 ^m	Sept. 23 ^d 01 ^h 00 ^m
Aphelion ...	July 2	Solstices ...	June 21 09 43	Dec. 21 20 27

SUPERIOR PLANETS

	Stationary	Opposition	Stationary	Conjunction
Mars	Nov. 21	Dec. 30	—	—
Jupiter	Apr. 20	June 20	Aug. 20	—
Saturn	Apr. 27	July 7	Sept. 15	—
Uranus	Dec. 1	Feb. 8	Apr. 24	Aug. 14
Neptune	Feb. 10	Apr. 28	July 18	Nov. 1
Pluto	Dec. 16	Feb. 24	May 19	Aug. 29

HELIOCENTRIC PHENOMENA

	Perihelion	Aphelion	Ascending Node	Greatest Lat. North	Descending Node	Greatest Lat. South
Mercury	—	Jan. 9	—	—	—	Jan. 30
	Feb. 22	Apr. 6	Feb. 18	Mar. 4	Mar. 27	Apr. 27
	May 20	July 3	May 16	May 31	June 23	July 24
	Aug. 16	Sept. 29	Aug. 12	Aug. 27	Sept. 19	Oct. 20
	Nov. 12	Dec. 26	Nov. 8	Nov. 23	Dec. 16	—
Venus	—	Mar. 26	—	—	Feb. 21	Apr. 18
	July 17	Nov. 6	June 13	Aug. 7	Oct. 2	Nov. 28
Mars	May 26	—	Sept. 25	—	—	May 1

Jupiter : Descending Node ... Nov. 4

Saturn, Uranus, Neptune, Pluto : None

ECLIPSES

Mar. 13	Total eclipse of the Moon	Americas, Arctic, Pacific Ocean, Australasia, E. Asia
Mar. 27	Partial eclipse of the Sun	S. Australia, Antarctica
Sept. 5	Total eclipse of the Moon	Americas, Antarctica, Pacific Ocean, India, E. Asia
Sept. 20-21	Partial eclipse of the Sun	E. Siberia, N. America
Nov. 7	Transit of Mercury	Europe, Africa, Americas, Pacific Ocean

OCCULTATIONS OF PLANETS AND BRIGHT STARS

Date	Body	Area of Visibility	Date	Body	Area of Visibility
Jan. 10 09	<i>Aldebaran</i>	E. Asia, N. America	June 22 04	<i>Aldebaran</i>	N. Africa, Europe, Asia
Feb. 6 16	<i>Aldebaran</i>	Europe, N. Africa, Asia	July 19 10	<i>Aldebaran</i>	N. America, Europe, N. Africa
Mar. 5 00	<i>Aldebaran</i>	N. America, W. Europe	Aug. 15 17	<i>Aldebaran</i>	Pacific, Americas
Mar. 25 12	Mercury	America, Europe, N. Africa	Aug. 23 22	Venus	Antarctica
Apr. 1 08	<i>Aldebaran</i>	Asia	Sept. 12 01	<i>Aldebaran</i>	North Africa, Asia
Apr. 24 01	Mercury	Central Russia, N. Pole	Oct. 9 09	<i>Aldebaran</i>	North America, Iberia
Apr. 24 13	Venus	S. America, S. Africa	Nov. 5 18	<i>Aldebaran</i>	Asia
Apr. 28 16	<i>Aldebaran</i>	N. America, Europe, N. Africa	Dec. 3 01	<i>Aldebaran</i>	N. America, Europe, N. Africa, Asia
May 20 22	Mars	E. Indies, N. Australia, Pacific	Dec. 30 07	<i>Aldebaran</i>	North America

DIARY

d h		d h	
Jan. 0 14	Ceres in conjunction with Sun	Feb. 17 03	Venus $1^{\circ}.1$ N. of Mars
5 19	FIRST QUARTER	18 10	Neptune 2° S. of Moon
9 04	Venus 7° N. of <i>Antares</i>	20 00	LAST QUARTER
10 09	<i>Aldebaran</i> $0^{\circ}.7$ S. of Moon, <i>Occⁿ</i> .	22 00	Jupiter 5° S. of Moon
10 13	Moon at apogee	23 03	Moon at perigee
11 04	Mercury $1^{\circ}.8$ S. of Saturn	23 04	Saturn 4° S. of Moon
14 00	FULL MOON	24 00	Mercury greatest elong. E. (18°)
16 07	Uranus 4° N. of Moon	24 07	Mars 5° S. of Moon
21 11	Venus $1^{\circ}.1$ N. of Jupiter	24 12	Pluto at opposition
21 15	LAST QUARTER	24 13	Venus 4° S. of Moon
22 05	Neptune 2° S. of Moon	26 18	NEW MOON
25 08	Jupiter 5° S. of Moon	28 00	Mercury 3° N. of Moon
25 15	Venus 4° S. of Moon	Mar. 1 02	Mercury stationary
26 09	Mars 6° S. of Moon	5 00	<i>Aldebaran</i> $0^{\circ}.4$ S. of Moon, <i>Occⁿ</i> .
26 10	Moon at perigee	5 11	FIRST QUARTER
26 15	Saturn 4° S. of Moon	6 02	Moon at apogee
26 15	Mercury in superior conjunction	10 18	Uranus 4° N. of Moon
28 06	NEW MOON	10 21	Mercury in inferior conjunction
31 11	Mars $1^{\circ}.2$ S. of Saturn	13 08	FULL MOON, <i>Eclipse</i>
Feb. 4 14	FIRST QUARTER	16 16	Neptune 2° S. of Moon
6 16	<i>Aldebaran</i> $0^{\circ}.5$ S. of Moon, <i>Occⁿ</i> .	19 07	Moon at perigee
7 06	Moon at apogee	20 07	LAST QUARTER
7 11	Venus $0^{\circ}.2$ N. of Saturn	20 11	Jupiter 5° S. of Moon
8 19	Uranus at opposition	20 15	Equinox
10 14	Neptune stationary	21 14	Saturn 4° S. of Moon
12 12	Uranus 4° N. of Moon	23 07	Mercury stationary
12 17	FULL MOON	24 04	Mars 4° S. of Moon

d	h		d	h	
Mar.	25 09	Mercury $1^{\circ}.9$ N. of Venus	June	10 18	Juno at opposition
	25 12	Mercury $0^{\circ}.7$ S. of Moon, <i>Occⁿ</i> .		11 10	Saturn 4° S. of Moon
	25 12	Venus 2° S. of Moon		16 05	LAST QUARTER
	27 08	NEW MOON, <i>Eclipse</i>		18 19	Mars 2° N. of Moon
Apr.	1 08	<i>Aldebaran</i> $0^{\circ}.4$ S. of Moon, <i>Occⁿ</i> .		19 14	Mercury greatest elong. E. (25°)
	2 22	Moon at apogee		20 02	Jupiter at opposition
	4 07	FIRST QUARTER		20 05	Mercury 6° S. of <i>Poliux</i>
	7 02	Uranus 4° N. of Moon		21 10	Solstice
	7 13	Mercury greatest elong. W. (28°)		22 04	<i>Aldebaran</i> $0^{\circ}.5$ S. of Moon, <i>Occⁿ</i> .
	11 20	FULL MOON		22 16	Venus in superior conjunction
	12 23	Neptune 2° S. of Moon		24 03	NEW MOON
	14 19	Moon at perigee		24 10	Moon at apogee
	16 19	Jupiter 5° S. of Moon		26 09	Mercury 3° N. of Moon
	16 20	Juno stationary		28 02	Uranus 3° N. of Moon
	17 21	Saturn 4° S. of Moon		28 21	Ceres stationary
	18 13	LAST QUARTER	July	2 04	FIRST QUARTER
	20 05	Jupiter stationary		2 14	Vesta at opposition
	22 01	Mars 2° S. of Moon		2 20	Mercury stationary
	24 01	Mercury 1° S. of Moon, <i>Occⁿ</i> .		4 01	Neptune 2° S. of Moon
	24 13	Venus $0^{\circ}.7$ N. of Moon, <i>Occⁿ</i> .		7 06	Saturn at opposition
	24 13	Uranus stationary		7 12	Jupiter 5° S. of Moon
	25 22	NEW MOON		8 11	Moon at perigee
	27 15	Saturn stationary		8 18	Saturn 4° S. of Moon
	28 02	Neptune at opposition		8 20	FULL MOON
	28 16	<i>Aldebaran</i> $0^{\circ}.5$ S. of Moon, <i>Occⁿ</i> .		11 17	Pallas at opposition
	30 16	Moon at apogee		15 16	LAST QUARTER
May	4 01	FIRST QUARTER		17 01	Mercury in inferior conjunction
	4 10	Uranus 4° N. of Moon		17 17	Mars 3° N. of Moon
	6 02	Mercury $0^{\circ}.2$ S. of Venus		18 22	Neptune stationary
	10 07	Neptune 2° S. of Moon		19 10	<i>Aldebaran</i> $0^{\circ}.4$ S. of Moon, <i>Occⁿ</i> .
	10 08	Pallas stationary		21 14	Moon at apogee
	11 06	FULL MOON		23 19	NEW MOON
	12 18	Moon at perigee		25 11	Uranus 3° N. of Moon
	14 01	Jupiter 5° S. of Moon		27 11	Mercury stationary
	15 03	Saturn 4° S. of Moon		31 08	Neptune 2° S. of Moon
	17 15	Mercury in superior conjunction		31 13	FIRST QUARTER
	17 20	LAST QUARTER	Aug.	1 15	Venus $1^{\circ}.8$ N. of Uranus
	19 07	Pluto stationary		3 18	Jupiter 5° S. of Moon
	20 22	Mars $0^{\circ}.1$ S. of Moon, <i>Occⁿ</i> .		5 01	Saturn 4° S. of Moon
	21 03	Vesta stationary		5 17	Mercury 8° S. of <i>Pollux</i>
	25 12	NEW MOON		5 19	Mercury greatest elong. W. (19°)
	28 04	Moon at apogee		5 20	Moon at perigee
	31 18	Uranus 4° N. of Moon		7 03	FULL MOON
June	2 16	FIRST QUARTER		8 11	Juno stationary
	6 17	Neptune 2° S. of Moon		8 14	Venus 1° N. of <i>Regulus</i>
	9 13	FULL MOON		14 03	Vesta stationary
	10 02	Moon at perigee		14 05	Uranus in conjunction with Sun
	10 07	Jupiter 5° S. of Moon		14 06	LAST QUARTER

	d	h		d	h		
Aug.	14	20	Ceres at opposition	Oct.	24	22	Jupiter 5° S. of Moon
	15	14	Mars 4° N. of Moon		25	21	Saturn 4° S. of Moon
	15	17	<i>Aldebaran</i> 0°.3 S. of Moon, <i>Occⁿ</i> .		27	08	FIRST QUARTER
	17	12	Mars 5° N. of <i>Aldebaran</i>		27	19	Mercury stationary
	18	01	Moon at apogee		28	20	Venus 3° N. of <i>Antares</i>
	20	18	Jupiter stationary	Nov.	1	07	Neptune in conjunction with Sun
	22	09	NEW MOON		3	12	FULL MOON
	23	22	Venus 1° N. of Moon, <i>Occⁿ</i> .		5	18	<i>Aldebaran</i> 0°.4 S. of Moon, <i>Occⁿ</i> .
	27	14	Neptune 2° S. of Moon		7	17	Mercury in inferior conjunction, transit over Sun
	29	06	Pluto in conjunction with Sun		9	00	Mars 6° N. of Moon
	29	19	FIRST QUARTER		9	09	Moon at apogee
	31	00	Mercury in superior conjunction		11	14	LAST QUARTER
	31	01	Jupiter 5° S. of Moon		12	04	Uranus 2° N. of Moon
Sept.	1	08	Saturn 4° S. of Moon		13	01	Mercury 0°.2 S. of Neptune
	1	15	Pallas stationary		16	14	Mercury stationary
	2	21	Moon at perigee		17	16	Mercury 2° S. of Moon
	5	11	FULL MOON, <i>Eclipse</i>		17	18	Neptune 3° S. of Moon
	12	01	<i>Aldebaran</i> 0°.2 S. of Moon, <i>Occⁿ</i> .		19	00	NEW MOON
	12	22	LAST QUARTER		19	02	Venus 2°.0 S. of Jupiter
	13	10	Mars 5° N. of Moon		20	19	Mercury 0°.8 N. of Neptune
	14	18	Moon at apogee		21	04	Moon at perigee
	15	20	Saturn stationary		21	05	Mars stationary
	18	07	Uranus 3° N. of Moon		21	15	Jupiter 5° S. of Moon
	20	22	Venus 3° N. of <i>Spica</i>		21	19	Venus 7° S. of Moon
	20	23	NEW MOON, <i>Eclipse</i>		22	08	Saturn 4° S. of Moon
	22	06	Mercury 3° S. of Moon		24	08	Mercury greatest elong. W. (20°)
	22	22	Venus 3° S. of Moon		25	16	FIRST QUARTER
	23	01	Equinox		28	07	Venus 2°.4 S. of Saturn
	23	21	Neptune 3° S. of Moon	Dec.	1	11	Uranus stationary
	26	16	Mercury 1° N. of <i>Spica</i>		3	01	<i>Aldebaran</i> 0°.5 S. of Moon, <i>Occⁿ</i> .
	27	10	Jupiter 5° S. of Moon		3	04	FULL MOON
	28	01	FIRST QUARTER		6	06	Mars 7° N. of Moon
	28	14	Saturn 4° S. of Moon		7	03	Moon at apogee
	29	22	Moon at perigee		9	12	Uranus 2° N. of Moon
Oct.	4	03	Venus 1°.9 S. of Neptune		11	10	LAST QUARTER
	4	22	FULL MOON		13	08	Mercury 5° N. of <i>Antares</i>
	8	06	Ceres stationary		15	06	Neptune 3° S. of Moon
	8	22	Mercury 4°.3 S. of Neptune		16	03	Pluto stationary
	9	09	<i>Aldebaran</i> 0°.3 S. of Moon, <i>Occⁿ</i> .		18	11	NEW MOON
	11	22	Mars 5° N. of Moon		19	11	Moon at perigee
	12	13	Moon at apogee		19	22	Saturn 4° S. of Moon
	12	17	LAST QUARTER		21	15	Venus 4° S. of Moon
	15	18	Uranus 3° N. of Moon		21	20	Solstice
	15	22	Mercury greatest elong. E. (25°)		25	02	FIRST QUARTER
	20	12	NEW MOON		25	06	Mars nearest to Earth
	22	04	Mercury 8° S. of Moon		30	07	<i>Aldebaran</i> 0°.4 S. of Moon, <i>Occⁿ</i> .
	22	21	Venus 6° S. of Moon		30	10	Mars at opposition
	24	20	Moon at perigee				

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T.

Date	Mercury		Venus		Date	Mercury		Venus	
	Elong.	Mag.	Elong.	Mag.		Elong.	Mag.	Elong.	Mag.
Jan. -3	W. 16°	-0.4	W. 42°	-3.7	June 30	E. 22°	+1.4	E. 2°	-3.5
2	14	0.4	41	3.6	July 5	17	1.8	3	3.5
7	12	0.4	40	3.6	10	12	2.3	5	3.4
12	9	0.5	39	3.6	15	E. 6	2.9	6	3.4
17	6	0.7	38	3.6	20	W. 7	2.8	8	3.4
22	W. 4	-0.8	W. 37	-3.5	25	W. 13	+2.0	E. 9	-3.4
27	E. 2	1.0	36	3.5	30	17	1.3	10	3.4
Feb. 1	4	1.1	35	3.5	Aug. 4	19	+0.6	12	3.4
6	8	1.1	34	3.4	9	19	-0.1	13	3.4
11	12	1.1	33	3.4	14	16	0.7	14	3.3
16	E. 15	-0.9	W. 32	-3.4	19	W. 12	-1.1	E. 16	-3.3
21	18	-0.5	31	3.4	24	7	1.4	17	3.3
26	18	+0.1	30	3.4	29	W. 3	1.5	18	3.3
Mar. 2	15	1.0	29	3.4	Sept. 3	E. 3	1.3	20	3.3
7	E. 8	2.2	28	3.3	8	7	0.9	21	3.3
12	W. 4	+2.9	W. 26	-3.3	13	E. 11	-0.6	E. 22	-3.3
17	12	2.0	25	3.3	18	14	0.4	24	3.3
22	19	1.4	24	3.3	23	17	0.2	25	3.3
27	24	1.0	23	3.3	28	20	-0.1	26	3.3
Apr. 1	27	0.8	22	3.3	Oct. 3	22	0.0	27	3.4
6	W. 28	+0.6	W. 21	-3.3	8	E. 24	+0.1	E. 29	-3.4
11	28	0.5	19	3.3	13	25	0.1	30	3.4
16	26	0.3	18	3.3	18	25	0.2	31	3.4
21	24	+0.1	17	3.3	23	23	0.4	32	3.4
26	21	-0.1	15	3.3	28	20	0.7	33	3.4
May 1	W. 18	-0.4	W. 14	-3.3	Nov. 2	E. 12	+1.5	E. 34	-3.4
6	13	0.8	13	3.3	7	E. 2	2.9	35	3.5
11	8	1.3	12	3.4	12	W. 9	1.6	36	3.5
16	W. 2	1.8	10	3.4	17	17	+0.4	37	3.5
21	E. 4	1.7	9	3.4	22	20	-0.2	38	3.5
26	E. 10	-1.3	W. 8	-3.4	27	W. 20	-0.4	E. 39	-3.5
31	15	0.8	6	3.4	Dec. 2	18	0.5	40	3.6
June 5	19	-0.3	5	3.4	7	16	0.5	41	3.6
10	23	+0.1	3	3.5	12	14	0.5	42	3.6
15	24	0.5	2	3.5	17	11	0.5	43	3.7
20	E. 25	+0.8	W. 1	-3.5	22	W. 8	-0.6	E. 44	-3.7
25	24	1.1	E. 1	3.5	27	6	0.6	44	3.8
30	E. 22	+1.4	E. 2	-3.5	32	W. 3	-0.7	E. 45	-3.8

MINOR PLANETS

		Conjunction	Stationary	Opposition	Stationary
Ceres	...	Jan. 0	June 28	Aug. 14	Oct. 8
Pallas	...	—	May 10	July 11	Sept. 1
Juno	...	—	Apr. 16	June 10	Aug. 8
Vesta	...	—	May 21	July 2	Aug. 14

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T.

Date	Mars		Jupiter		Saturn		Uranus	Neptune	Pluto
	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Elong.	Elong.
Jan. -3	W. 18 [°]	+1.7	W. 18 [°]	-1.3	E. 4 [°]	+0.7	W. 135 [°]	W. 57 [°]	W. 119 [°]
7	21	1.6	26	1.4	W. 6	0.7	145	67	129
17	24	1.6	34	1.4	15	0.7	156	77	138
27	27	1.6	42	1.4	24	0.8	166	87	148
Feb. 6	29	1.5	50	1.5	33	0.8	W. 177	97	157
16	W. 32	+1.5	W. 58	-1.5	W. 42	+0.8	E. 172	W. 107	W. 165
26	34	1.5	67	1.6	51	0.8	162	117	E. 167
Mar. 7	37	1.4	76	1.6	60	0.8	151	127	163
17	39	1.4	85	1.7	69	0.8	141	138	155
27	41	1.3	94	1.8	79	0.8	131	148	146
Apr. 6	W. 43	+1.3	W. 103	-1.8	W. 88	+0.8	E. 121	W. 158	E. 136
16	45	1.3	112	1.9	98	0.7	111	168	127
26	47	1.2	122	2.0	107	0.7	101	W. 177	117
May 6	49	1.2	132	2.0	117	0.6	92	E. 172	108
16	52	1.2	142	2.1	127	0.6	82	162	98
26	W. 54	+1.1	W. 153	-2.1	W. 137	+0.5	E. 73	E. 152	E. 89
June 5	56	1.1	164	2.2	147	0.5	63	142	80
15	58	1.0	W. 175	2.2	157	0.4	54	133	70
25	60	1.0	E. 175	2.2	167	0.3	45	123	61
July 5	62	1.0	164	2.2	W. 178	0.3	36	113	52
15	W. 65	+0.9	E. 153	-2.1	E. 172	+0.3	E. 27	E. 104	E. 43
25	68	0.8	143	2.1	162	0.3	18	94	35
Aug. 4	70	0.8	133	2.1	152	0.4	E. 9	85	26
14	73	0.7	123	2.0	141	0.5	0	75	19
24	77	0.6	113	1.9	131	0.5	W. 9	66	E. 13
Sept. 3	W. 81	+0.6	E. 104	-1.9	E. 121	+0.6	W. 18	E. 56	W. 13
13	85	0.5	94	1.8	112	0.6	27	47	18
23	89	0.4	85	1.8	102	0.7	36	38	26
Oct. 3	94	0.2	77	1.7	92	0.7	46	28	35
13	100	+0.1	68	1.6	83	0.7	55	19	44
23	W. 106	-0.1	E. 60	-1.6	E. 73	+0.8	W. 64	E. 9	W. 53
Nov. 2	113	0.3	52	1.5	64	0.8	74	W. 2	63
12	121	0.5	44	1.5	55	0.8	84	10	72
22	131	0.7	36	1.5	46	0.8	94	20	82
Dec. 2	142	0.9	28	1.4	36	0.8	104	30	92
12	W. 154	-1.1	E. 20	-1.4	E. 27	+0.8	W. 114	W. 40	W. 102
22	W. 168	1.3	12	1.4	18	0.8	125	50	111
32	E. 176	-1.3	E. 4	-1.4	E. 9	+0.7	W. 135	W. 60	W. 121

Magnitudes at opposition : . Uranus 5.7 Neptune 7.7 Pluto 15

MAGNITUDES OF MINOR PLANETS

	Jan. 7	Feb. 16	Mar. 27	May 6	June 15	July 25	Sept. 3	Oct. 13	Nov. 22	Dec. 32
Ceres	9.2	9.2	9.0	8.7	8.3	7.9	7.9	8.3	8.7	9.1
Pallas	9.9	9.9	9.7	9.4	9.2	9.2	9.4	9.8	10.1	10.3
Juno	11.2	10.9	10.5	10.1	9.9	10.0	10.3	10.6	10.8	10.8
Vesta	7.9	7.5	7.1	6.5	6.0	6.1	6.7	7.3	7.8	8.2

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
Jan.	2436	^h ^m ^s	^s	^s	2443	^d ^h ^m ^s	^s
	0 933.5	6 34 41.772	41.762	+0.011	607.0	Jan. 0 17 22 26.976	26.990
	1 934.5	6 38 38.333	38.317	.016	608.0	1 17 18 31.063	31.081
	2 935.5	6 42 34.890	34.872	.018	609.0	2 17 14 35.154	35.172
	3 936.5	6 46 31.445	31.428	.017	610.0	3 17 10 39.246	39.262
	4 937.5	6 50 27.998	27.983	.015	611.0	4 17 06 43.340	43.353
	5 938.5	6 54 24.550	24.538	+0.012	612.0	5 17 02 47.433	47.443
	6 939.5	6 58 21.103	21.094	.009	613.0	6 16 58 51.526	51.534
	7 940.5	7 02 17.657	17.649	.007	614.0	7 16 54 55.617	55.624
	8 941.5	7 06 14.211	14.204	.007	615.0	8 16 50 59.707	59.715
	9 942.5	7 10 10.768	10.760	.008	616.0	9 16 47 03.796	03.805
	10 943.5	7 14 07.326	07.315	+0.011	617.0	10 16 43 07.883	07.896
	11 944.5	7 18 03.885	03.871	.014	618.0	11 16 39 11.969	11.986
	12 945.5	7 22 00.445	00.426	.019	619.0	12 16 35 16.055	16.077
	13 946.5	7 25 57.005	56.981	.023	620.0	13 16 31 20.141	20.167
	14 947.5	7 29 53.564	53.537	.027	621.0	14 16 27 24.229	24.258
	15 948.5	7 33 50.122	50.092	+0.030	622.0	15 16 23 28.317	28.348
	16 949.5	7 37 46.679	46.647	.031	623.0	16 16 19 32.408	32.439
	17 950.5	7 41 43.233	43.203	.031	624.0	17 16 15 36.501	36.530
	18 951.5	7 45 39.786	39.758	.028	625.0	18 16 11 40.594	40.620
	19 952.5	7 49 36.338	36.313	.025	626.0	19 16 07 44.689	44.711
	20 953.5	7 53 32.889	32.869	+0.021	627.0	20 16 03 48.783	48.801
	21 954.5	7 57 29.441	29.424	.017	628.0	21 15 59 52.876	52.892
	22 955.5	8 01 25.995	25.980	.015	629.0	22 15 55 56.967	56.982
	23 956.5	8 05 22.551	22.535	.016	630.0	23 15 52 01.055	01.073
	24 957.5	8 09 19.109	19.090	.019	631.0	24 15 48 05.141	05.163
Feb.	25 958.5	8 13 15.670	15.646	+0.024	632.0	25 15 44 09.225	09.254
	26 959.5	8 17 12.232	12.201	.031	633.0	26 15 40 13.309	13.344
	27 960.5	8 21 08.793	08.756	.037	634.0	27 15 36 17.395	17.435
	28 961.5	8 25 05.353	05.312	.041	635.0	28 15 32 21.483	21.525
	29 962.5	8 29 01.910	01.867	.043	636.0	29 15 28 25.574	25.616
	30 963.5	8 32 58.464	58.422	+0.041	637.0	30 15 24 29.667	29.706
	31 964.5	8 36 55.016	54.978	.038	638.0	31 15 20 33.763	33.797
	1 965.5	8 40 51.566	51.533	.033	639.0	Feb. 1 15 16 37.858	37.888
	2 966.5	8 44 48.116	48.089	.028	640.0	2 15 12 41.954	41.978
	3 967.5	8 48 44.667	44.644	.023	641.0	3 15 08 46.048	46.069
	4 968.5	8 52 41.219	41.199	+0.020	642.0	4 15 04 50.141	50.159
	5 969.5	8 56 37.773	37.755	.018	643.0	5 15 00 54.232	54.250
	6 970.5	9 00 34.328	34.310	.018	644.0	6 14 56 58.322	58.340
	7 971.5	9 04 30.884	30.865	.019	645.0	7 14 53 02.411	02.431
	8 972.5	9 08 27.442	27.421	.021	646.0	8 14 49 06.499	06.521
	9 973.5	9 12 23.999	23.976	+0.023	647.0	9 14 45 10.588	10.612
	10 974.5	9 16 20.556	20.531	.025	648.0	10 14 41 14.677	14.702
	11 975.5	9 20 17.112	17.087	.025	649.0	11 14 37 18.768	18.793
	12 976.5	9 24 13.667	13.642	.025	650.0	12 14 33 22.860	22.883
	13 977.5	9 28 10.219	10.198	.022	651.0	13 14 29 26.955	26.974
	14 978.5	9 32 06.770	06.753	+0.017	652.0	14 14 25 31.051	31.065
	15 979.5	9 36 03.320	03.308	+0.011	653.0	15 14 21 35.148	35.155

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2436				2443		
Feb. 15	979.5	^h ^m ^s 9 36 03.320	^s 03.308	+0.011	653.0	Feb. 15 ^d ^h ^m ^s 15 14 21 35.148	^s 35.155
16	980.5	9 39 59.868	59.864	+ .005	654.0	16 14 17 39.245	39.246
17	981.5	9 43 56.418	56.419	- .001	655.0	17 14 13 43.341	43.336
18	982.5	9 47 52.968	52.974	.006	656.0	18 14 09 47.435	47.427
19	983.5	9 51 49.520	49.530	.009	657.0	19 14 05 51.527	51.517
20	984.5	9 55 46.075	46.085	-0.010	658.0	20 14 01 55.617	55.608
21	985.5	9 59 42.632	42.640	.008	659.0	21 13 57 59.704	59.698
22	986.5	10 03 39.191	39.196	.005	660.0	22 13 54 03.792	03.789
23	987.5	10 07 35.750	35.751	- .001	661.0	23 13 50 07.879	07.879
24	988.5	10 11 32.307	32.307	+ .001	662.0	24 13 46 11.969	11.970
25	989.5	10 15 28.863	28.862	+0.001	663.0	25 13 42 16.061	16.060
26	990.5	10 19 25.415	25.417	- .002	664.0	26 13 38 20.156	20.151
27	991.5	10 23 21.965	21.973	.008	665.0	27 13 34 24.253	24.241
28	992.5	10 27 18.513	18.528	.015	666.0	28 13 30 28.351	28.332
29	993.5	10 31 15.061	15.083	.022	667.0	29 13 26 32.449	32.423
Mar. 1	994.5	10 35 11.609	11.639	-0.030	668.0	Mar. 1 13 22 36.546	36.513
2	995.5	10 39 08.158	08.194	.036	669.0	2 13 18 40.642	40.604
3	996.5	10 43 04.709	04.749	.040	670.0	3 13 14 44.736	44.694
4	997.5	10 47 01.261	01.305	.043	671.0	4 13 10 48.829	48.785
5	998.5	10 50 57.815	57.860	.045	672.0	5 13 06 52.920	52.875
6	999.5	10 54 54.370	54.416	-0.046	673.0	6 13 02 57.011	56.966
7	*000.5	10 58 50.925	50.971	.046	674.0	7 12 59 01.102	01.056
8	*001.5	11 02 47.481	47.526	.046	675.0	8 12 55 05.193	05.147
9	*002.5	11 06 44.035	44.082	.047	676.0	9 12 51 09.285	09.237
10	*003.5	11 10 40.588	40.637	.049	677.0	10 12 47 13.378	13.328
11	*004.5	11 14 37.140	37.192	-0.053	678.0	11 12 43 17.474	17.418
12	*005.5	11 18 33.689	33.748	.058	679.0	12 12 39 21.571	21.509
13	*006.5	11 22 30.237	30.303	.066	680.0	13 12 35 25.669	25.600
14	*007.5	11 26 26.785	26.858	.074	681.0	14 12 31 29.768	29.690
15	*008.5	11 30 23.332	23.414	.082	682.0	15 12 27 33.866	33.781
16	*009.5	11 34 19.880	19.969	-0.089	683.0	16 12 23 37.963	37.871
17	*010.5	11 38 16.431	16.525	.094	684.0	17 12 19 42.057	41.962
18	*011.5	11 42 12.984	13.080	.096	685.0	18 12 15 46.148	46.052
19	*012.5	11 46 09.539	09.635	.096	686.0	19 12 11 50.238	50.143
20	*013.5	11 50 06.096	06.191	.095	687.0	20 12 07 54.326	54.233
21	*014.5	11 54 02.654	02.746	-0.093	688.0	21 12 03 58.415	58.324
22	*015.5	11 57 59.210	59.301	.091	689.0	22 12 00 02.505	02.414
23	*016.5	12 01 55.765	55.857	.092	690.0	23 11 56 06.598	06.505
24	*017.5	12 05 52.317	52.412	.095	691.0	24 11 52 10.693	10.595
25	*018.5	12 09 48.867	48.967	.101	692.0	25 11 48 14.790	14.686
26	*019.5	12 13 45.415	45.523	-0.108	693.0	26 11 44 18.888	18.776
27	*020.5	12 17 41.962	42.078	.116	694.0	27 11 40 22.987	22.867
28	*021.5	12 21 38.509	38.634	.125	695.0	28 11 36 27.085	26.958
29	*022.5	12 25 35.057	35.189	.132	696.0	29 11 32 31.182	31.048
30	*023.5	12 29 31.607	31.744	.137	697.0	30 11 28 35.277	35.139
31	*024.5	12 33 28.159	28.300	-0.141	698.0	31 11 24 39.371	39.229
Apr. 1	*025.5	12 37 24.712	24.855	-0.143	699.0	Apr. 1 11 20 43.463	43.320

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
Apr.	2437	^h ^m ^s	^s	^s	2443	^d ^h ^m ^s	^s
	1 025.5	12 37 24.712	24.855	-0.143	699.0	1 11 20 43.463	43.320
	2 026.5	12 41 21.266	21.410	.144	700.0	2 11 16 47.554	47.410
	3 027.5	12 45 17.821	17.966	.144	701.0	3 11 12 51.645	51.501
	4 028.5	12 49 14.377	14.521	.145	702.0	4 11 08 55.736	55.591
	5 029.5	12 53 10.931	11.076	.145	703.0	5 11 04 59.827	59.682
	6 030.5	12 57 07.485	07.632	-0.147	704.0	6 11 01 03.920	03.772
	7 031.5	13 01 04.037	04.187	.150	705.0	7 10 57 08.014	07.863
	8 032.5	13 05 00.588	00.743	.154	706.0	8 10 53 12.110	11.953
	9 033.5	13 08 57.137	57.298	.161	707.0	9 10 49 16.208	16.044
	10 034.5	13 12 53.685	53.853	.168	708.0	10 10 45 20.306	20.134
	11 035.5	13 16 50.233	50.409	-0.176	709.0	11 10 41 24.404	24.225
	12 036.5	13 20 46.781	46.964	.183	710.0	12 10 37 28.500	28.316
	13 037.5	13 24 43.332	43.519	.188	711.0	13 10 33 32.594	32.406
	14 038.5	13 28 39.885	40.075	.190	712.0	14 10 29 36.686	36.497
	15 039.5	13 32 36.441	36.630	.189	713.0	15 10 25 40.775	40.587
	16 040.5	13 36 32.999	33.186	-0.186	714.0	16 10 21 44.862	44.678
	17 041.5	13 40 29.558	29.741	.183	715.0	17 10 17 48.949	48.768
	18 042.5	13 44 26.116	26.296	.180	716.0	18 10 13 53.038	52.859
	19 043.5	13 48 22.672	22.852	.179	717.0	19 10 09 57.128	56.949
	20 044.5	13 52 19.227	19.407	.180	718.0	20 10 06 01.221	01.040
	21 045.5	13 56 15.778	15.962	-0.184	719.0	21 10 02 05.316	05.130
	22 046.5	14 00 12.328	12.518	.190	720.0	22 09 58 09.413	09.221
	23 047.5	14 04 08.877	09.073	.196	721.0	23 09 54 13.510	13.311
	24 048.5	14 08 05.425	05.628	.203	722.0	24 09 50 17.607	17.402
	25 049.5	14 12 01.975	02.184	.209	723.0	25 09 46 21.703	21.493
	26 050.5	14 15 58.525	58.739	-0.214	724.0	26 09 42 25.797	25.583
	27 051.5	14 19 55.078	55.295	.216	725.0	27 09 38 29.890	29.674
	28 052.5	14 23 51.633	51.850	.217	726.0	28 09 34 33.981	33.764
	29 053.5	14 27 48.188	48.405	.217	727.0	29 09 30 38.070	37.855
	30 054.5	14 31 44.745	44.961	.215	728.0	30 09 26 42.159	41.945
May	1 055.5	14 35 41.302	41.516	-0.214	729.0	May 1 09 22 46.248	46.036
	2 056.5	14 39 37.859	38.071	.212	730.0	2 09 18 50.337	50.126
	3 057.5	14 43 34.416	34.627	.211	731.0	3 09 14 54.427	54.217
	4 058.5	14 47 30.970	31.182	.212	732.0	4 09 10 58.519	58.307
	5 059.5	14 51 27.523	27.737	.214	733.0	5 09 07 02.612	02.398
	6 060.5	14 55 24.075	24.293	-0.218	734.0	6 09 03 06.707	06.488
	7 061.5	14 59 20.626	20.848	.223	735.0	7 08 59 10.803	10.579
	8 062.5	15 03 17.175	17.404	.228	736.0	8 08 55 14.899	14.669
	9 063.5	15 07 13.726	13.959	.233	737.0	9 08 51 18.994	18.760
	10 064.5	15 11 10.277	10.514	.237	738.0	10 08 47 23.088	22.851
	11 065.5	15 15 06.832	07.070	-0.238	739.0	11 08 43 27.178	26.941
	12 066.5	15 19 03.389	03.625	.236	740.0	12 08 39 31.265	31.032
	13 067.5	15 22 59.949	60.180	.231	741.0	13 08 35 35.350	35.122
	14 068.5	15 26 56.511	56.736	.225	742.0	14 08 31 39.435	39.213
	15 069.5	15 30 53.072	53.291	.219	743.0	15 08 27 43.520	43.303
	16 070.5	15 34 49.632	49.846	-0.215	744.0	16 08 23 47.607	47.394
	17 071.5	15 38 46.189	46.402	-0.213	745.0	17 08 19 51.697	51.484

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries		
		Apparent	Mean			Apparent	Mean	
	2437	^h ^m ^s	^s	^s	2443	^d ^h ^m ^s	^s	
May	17	071.5	15 38 46.189	46.402	-0.213	745.0	May 17 08 19 51.697	51.484
	18	072.5	15 42 42.744	42.957	.214	746.0	18 08 15 55.789	55.575
	19	073.5	15 46 39.296	39.513	.217	747.0	19 08 11 59.883	59.665
	20	074.5	15 50 35.847	36.068	.221	748.0	20 08 08 03.978	03.756
	21	075.5	15 54 32.398	32.623	.225	749.0	21 08 04 08.073	07.846
	22	076.5	15 58 28.949	29.179	-0.229	750.0	22 08 00 12.167	11.937
	23	077.5	16 02 25.502	25.734	.232	751.0	23 07 56 16.259	16.027
	24	078.5	16 06 22.056	22.289	.233	752.0	24 07 52 20.350	20.118
	25	079.5	16 10 18.612	18.845	.232	753.0	25 07 48 24.440	24.209
	26	080.5	16 14 15.170	15.400	.230	754.0	26 07 44 28.527	28.299
	27	081.5	16 18 11.729	11.955	-0.227	755.0	27 07 40 32.614	32.390
June	1	086.5	16 37 54.519	54.732	-0.213	760.0	June 1 07 20 53.055	52.842
	2	087.5	16 41 51.073	51.288	.215	761.0	2 07 16 57.148	56.933
	3	088.5	16 45 47.626	47.843	.217	762.0	3 07 13 01.241	01.023
	4	089.5	16 49 44.178	44.398	.221	763.0	4 07 09 05.335	05.114
	5	090.5	16 53 40.729	40.954	.224	764.0	5 07 05 09.429	09.204
	6	091.5	16 57 37.282	37.509	-0.227	765.0	6 07 01 13.522	13.295
	7	092.5	17 01 33.837	34.064	.227	766.0	7 06 57 17.612	17.386
	8	093.5	17 05 30.395	30.620	.225	767.0	8 06 53 21.699	21.476
	9	094.5	17 09 26.956	27.175	.219	768.0	9 06 49 25.783	25.567
	10	095.5	17 13 23.519	23.731	.212	769.0	10 06 45 29.866	29.657
	11	096.5	17 17 20.082	20.286	-0.204	770.0	11 06 41 33.948	33.748
July	1	116.5	18 36 11.212	11.393	-0.182	790.0	July 1 05 22 55.740	55.558
	2	117.5	18 40 07.763	07.949	-0.185	791.0	2 05 18 59.834	59.649

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
July	2437	^{h m s}	^s	^s	2443	^{d h m s}	^s
	1 116.5	18 36 11.212	11.393	-0.182	791.0	July 2 05 18 59.834	59.649
	2 117.5	18 40 07.763	07.949	.185	792.0	3 05 15 03.928	03.739
	3 118.5	18 44 04.316	04.504	.188	793.0	4 05 11 08.019	07.830
	4 119.5	18 48 00.870	01.059	.189	794.0	5 05 07 12.108	11.920
	5 120.5	18 51 57.426	57.615	.189	795.0	6 05 03 16.194	16.011
	6 121.5	18 55 53.985	54.170	-0.185	796.0	7 04 59 20.277	20.102
	7 122.5	18 59 50.547	50.725	.178	797.0	8 04 55 24.360	24.192
	8 123.5	19 03 47.111	47.281	.170	798.0	9 04 51 28.443	28.283
	9 124.5	19 07 43.674	43.836	.162	799.0	10 04 47 32.529	32.373
	10 125.5	19 11 40.235	40.391	.157	800.0	11 04 43 36.617	36.464
	11 126.5	19 15 36.793	36.947	-0.154	801.0	12 04 39 40.708	40.554
	12 127.5	19 19 33.348	33.502	.154	802.0	13 04 35 44.802	44.645
	13 128.5	19 23 29.901	30.058	.157	803.0	14 04 31 48.896	48.735
	14 129.5	19 27 26.453	26.613	.160	804.0	15 04 27 52.990	52.826
	15 130.5	19 31 23.004	23.168	.164	805.0	16 04 23 57.084	56.916
	16 131.5	19 35 19.556	19.724	-0.167	806.0	17 04 20 01.176	01.007
	17 132.5	19 39 16.110	16.279	.169	807.0	18 04 16 05.266	05.097
	18 133.5	19 43 12.665	12.834	.169	808.0	19 04 12 09.355	09.188
	19 134.5	19 47 09.222	09.390	.168	809.0	20 04 08 13.442	13.279
	20 135.5	19 51 05.780	05.945	.165	810.0	21 04 04 17.529	17.369
	21 136.5	19 55 02.339	02.500	-0.161	811.0	22 04 00 21.616	21.460
	22 137.5	19 58 58.898	59.056	.158	812.0	23 03 56 25.704	25.550
	23 138.5	20 02 55.456	55.611	.155	813.0	24 03 52 29.793	29.641
	24 139.5	20 06 52.014	52.167	.153	814.0	25 03 48 33.883	33.731
	25 140.5	20 10 48.569	48.722	.152	815.0	26 03 44 37.976	37.822
	26 141.5	20 14 45.123	45.277	-0.154	816.0	27 03 40 42.069	41.912
	27 142.5	20 18 41.676	41.833	.157	817.0	28 03 36 46.164	46.003
	28 143.5	20 22 38.227	38.388	.161	818.0	29 03 32 50.260	50.093
	29 144.5	20 26 34.777	34.943	.166	819.0	30 03 28 54.355	54.184
	30 145.5	20 30 31.328	31.499	.171	820.0	31 03 24 58.449	58.274
Aug.	31 146.5	20 34 27.879	28.054	-0.175	821.0	Aug. 1 03 21 02.541	02.365
	1 147.5	20 38 24.433	24.609	.176	822.0	2 03 17 06.630	06.455
	2 148.5	20 42 20.989	21.165	.176	823.0	3 03 13 10.717	10.546
	3 149.5	20 46 17.548	17.720	.172	824.0	4 03 09 14.802	14.637
	4 150.5	20 50 14.109	14.276	.167	825.0	5 03 05 18.887	18.727
	5 151.5	20 54 10.670	10.831	-0.161	826.0	6 03 01 22.973	22.818
	6 152.5	20 58 07.230	07.386	.157	827.0	7 02 57 27.062	26.908
	7 153.5	21 02 03.787	03.942	.154	828.0	8 02 53 31.154	30.999
	8 154.5	21 06 00.342	00.497	.155	829.0	9 02 49 35.248	35.089
	9 155.5	21 09 56.894	57.052	.159	830.0	10 02 45 39.344	39.180
	10 156.5	21 13 53.443	53.608	-0.164	831.0	11 02 41 43.441	43.270
	11 157.5	21 17 49.993	50.163	.170	832.0	12 02 37 47.537	47.361
	12 158.5	21 21 46.543	46.718	.176	833.0	13 02 33 51.631	51.451
	13 159.5	21 25 43.094	43.274	.180	834.0	14 02 29 55.724	55.542
	14 160.5	21 29 39.646	39.829	.183	835.0	15 02 25 59.816	59.632
	15 161.5	21 33 36.201	36.385	-0.184	836.0	16 02 22 03.906	03.723
	16 162.5	21 37 32.756	32.940	-0.184	837.0	17 02 18 07.995	07.813

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2437	^h ^m ^s	^s	^s	2443	^d ^h ^m ^s	^s
Aug. 16	162.5	21 37 32.756	32.940	-0.184	837.0	Aug. 17 02 18 07.995	07.813
17	163.5	21 41 29.313	29.495	.183	838.0	18 02 14 12.085	11.904
18	164.5	21 45 25.870	26.051	.181	839.0	19 02 10 16.174	15.995
19	165.5	21 49 22.426	22.606	.180	840.0	20 02 06 20.265	20.085
20	166.5	21 53 18.981	19.161	.180	841.0	21 02 02 24.357	24.176
21	167.5	21 57 15.535	15.717	-0.181	842.0	22 01 58 28.450	28.266
22	168.5	22 01 12.088	12.272	.184	843.0	23 01 54 32.546	32.357
23	169.5	22 05 08.638	08.827	.189	844.0	24 01 50 36.643	36.447
24	170.5	22 09 05.187	05.383	.195	845.0	25 01 46 40.740	40.538
25	171.5	22 13 01.736	01.938	.203	846.0	26 01 42 44.838	44.628
26	172.5	22 16 58.284	58.494	-0.219	847.0	27 01 38 48.935	48.719
27	173.5	22 20 54.833	55.049	.216	848.0	28 01 34 53.029	52.809
28	174.5	22 24 51.384	51.604	.220	849.0	29 01 30 57.122	56.900
29	175.5	22 28 47.937	48.160	.223	850.0	30 01 27 01.212	00.990
30	176.5	22 32 44.493	44.715	.222	851.0	31 01 23 05.300	05.081
Sept. 31	177.5	22 36 41.050	41.270	-0.220	852.0	Sept. 1 01 19 09.388	09.172
1	178.5	22 40 37.609	37.826	.217	853.0	2 01 15 13.476	13.262
2	179.5	22 44 34.167	34.381	.215	854.0	3 01 11 17.566	17.353
3	180.5	22 48 30.723	30.936	.214	855.0	4 01 07 21.658	21.443
4	181.5	22 52 27.276	27.492	.215	856.0	5 01 03 25.753	25.534
5	182.5	22 56 23.827	24.047	-0.220	857.0	6 00 59 29.851	29.624
6	183.5	23 00 20.376	20.603	.227	858.0	7 00 55 33.949	33.715
7	184.5	23 04 16.923	17.158	.235	859.0	8 00 51 38.047	37.805
8	185.5	23 08 13.471	13.713	.243	860.0	9 00 47 42.145	41.896
9	186.5	23 12 10.019	10.269	.249	861.0	10 00 43 46.240	45.986
10	187.5	23 16 06.570	06.824	-0.254	862.0	11 00 39 50.334	50.077
11	188.5	23 20 03.122	03.379	.258	863.0	12 00 35 54.426	54.167
12	189.5	23 23 59.675	59.935	.259	864.0	13 00 31 58.517	58.258
13	190.5	23 27 56.230	56.490	.260	865.0	14 00 28 02.608	02.348
14	191.5	23 31 52.785	53.045	.260	866.0	15 00 24 06.699	06.439
15	192.5	23 35 49.340	49.601	-0.260	867.0	16 00 20 10.790	10.530
16	193.5	23 39 45.895	46.156	.261	868.0	17 00 16 14.883	14.620
17	194.5	23 43 42.448	42.712	.264	869.0	18 00 12 18.978	18.711
18	195.5	23 47 38.999	39.267	.268	870.0	19 00 08 23.074	22.801
19	196.5	23 51 35.549	35.822	.273	871.0	20 00 04 27.171	26.892
20	197.5	23 55 32.097	32.378	-0.280	872.0	21 00 00 31.270	30.982
21	198.5	23 59 28.644	28.933	.289	873.0	21 23 56 35.369	35.073
22	199.5	0 03 25.191	25.488	.297	874.0	22 23 52 39.467	39.163
23	200.5	0 07 21.739	22.044	.305	875.0	23 23 48 43.563	43.254
24	201.5	0 11 18.289	18.599	.310	876.0	24 23 44 47.658	47.344
25	202.5	0 15 14.840	15.154	-0.314	877.0	25 23 40 51.749	51.435
26	203.5	0 19 11.395	11.710	.315	878.0	26 23 36 55.839	55.525
27	204.5	0 23 07.951	08.265	.314	879.0	27 23 32 59.927	59.616
28	205.5	0 27 04.508	04.821	.312	880.0	28 23 29 04.016	03.707
29	206.5	0 31 01.066	01.376	.310	881.0	29 23 25 08.106	07.797
30	207.5	0 34 57.622	57.931	-0.310	882.0	30 23 21 12.198	11.888
Oct. 1	208.5	0 38 54.175	54.487	-0.311	883.0	Oct. 1 23 17 16.293	15.978

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2437	^h ^m ^s	^s	^s	2443	^d ^h ^m ^s	^s
Oct. 1	208.5	0 38 54.175	54.487	-0.311	883.0	Oct. 1 23 17 16.293	15.978
2	209.5	0 42 50.726	51.042	.316	884.0	2 23 13 20.390	20.069
3	210.5	0 46 47.275	47.597	.322	885.0	3 23 09 24.488	24.159
4	211.5	0 50 43.823	44.153	.330	886.0	4 23 05 28.587	28.250
5	212.5	0 54 40.370	40.708	.338	887.0	5 23 01 32.685	32.340
6	213.5	0 58 36.918	37.263	-0.346	888.0	6 22 57 36.781	36.431
7	214.5	1 02 33.468	33.819	.351	889.0	7 22 53 40.875	40.521
8	215.5	1 06 30.019	30.374	.355	890.0	8 22 49 44.968	44.612
9	216.5	1 10 26.573	26.930	.357	891.0	9 22 45 49.059	48.702
10	217.5	1 14 23.127	23.485	.358	892.0	10 22 41 53.149	52.793
11	218.5	1 18 19.683	20.040	-0.357	893.0	11 22 37 57.240	56.883
12	219.5	1 22 16.239	16.596	.357	894.0	12 22 34 01.330	00.974
13	220.5	1 26 12.794	13.151	.357	895.0	13 22 30 05.422	05.065
14	221.5	1 30 09.348	09.706	.358	896.0	14 22 26 09.515	09.155
15	222.5	1 34 05.901	06.262	.361	897.0	15 22 22 13.610	13.246
16	223.5	1 38 02.452	02.817	-0.365	898.0	16 22 18 17.706	17.336
17	224.5	1 41 59.001	59.372	.371	899.0	17 22 14 21.803	21.427
18	225.5	1 45 55.550	55.928	.378	900.0	18 22 10 25.901	25.517
19	226.5	1 49 52.098	52.483	.386	901.0	19 22 06 29.999	29.608
20	227.5	1 53 48.646	49.039	.393	902.0	20 22 02 34.095	33.698
21	228.5	1 57 45.196	45.594	-0.398	903.0	21 21 58 38.189	37.789
22	229.5	2 01 41.748	42.149	.401	904.0	22 21 54 42.280	41.879
23	230.5	2 05 38.303	38.705	.401	905.0	23 21 50 46.368	45.970
24	231.5	2 09 34.861	35.260	.399	906.0	24 21 46 50.455	50.060
25	232.5	2 13 31.420	31.815	.395	907.0	25 21 42 54.542	54.151
26	233.5	2 17 27.979	28.371	-0.392	908.0	26 21 38 58.630	58.241
27	234.5	2 21 24.537	24.926	.389	909.0	27 21 35 02.720	02.332
28	235.5	2 25 21.093	21.481	.389	910.0	28 21 31 06.812	06.423
29	236.5	2 29 17.646	18.037	.391	911.0	29 21 27 10.907	10.513
30	237.5	2 33 14.197	14.592	.395	912.0	30 21 23 15.003	14.604
31	238.5	2 37 10.747	11.148	-0.401	913.0	31 21 19 19.100	18.694
Nov. 1	239.5	2 41 07.296	07.703	.407	914.0	Nov. 1 21 15 23.196	22.785
2	240.5	2 45 03.845	04.258	.413	915.0	2 21 11 27.291	26.875
3	241.5	2 49 00.396	00.814	.417	916.0	3 21 07 31.384	30.966
4	242.5	2 52 56.949	57.369	.420	917.0	4 21 03 35.475	35.056
5	243.5	2 56 53.504	53.924	-0.420	918.0	5 20 59 39.565	39.147
6	244.5	3 00 50.061	50.480	.419	919.0	6 20 55 43.653	43.237
7	245.5	3 04 46.618	47.035	.417	920.0	7 20 51 47.741	47.328
8	246.5	3 08 43.177	43.590	.414	921.0	8 20 47 51.829	51.418
9	247.5	3 12 39.734	40.146	.411	922.0	9 20 43 55.918	55.509
10	248.5	3 16 36.291	36.701	-0.410	923.0	10 20 39 60.008	59.600
11	249.5	3 20 32.847	33.257	.410	924.0	11 20 36 04.100	03.690
12	250.5	3 24 29.401	29.812	.411	925.0	12 20 32 08.193	07.781
13	251.5	3 28 25.953	26.367	.414	926.0	13 20 28 12.287	11.871
14	252.5	3 32 22.505	22.923	.418	927.0	14 20 24 16.383	15.962
15	253.5	3 36 19.055	19.478	-0.423	928.0	15 20 20 20.478	20.052
16	254.5	3 40 15.606	16.033	-0.428	929.0	16 20 16 24.572	24.143

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2437	^h ^m ^s	^s	^s	2443	^d ^h ^m ^s	^s
Nov. 16	254.5	3 40 15.606	16.033	-0.428	929.0	Nov. 16 20 16 24.572	24.143
17	255.5	3 44 12.158	12.589	.431	930.0	17 20 12 28.665	28.233
18	256.5	3 48 08.711	09.144	.433	931.0	18 20 08 32.754	32.324
19	257.5	3 52 05.268	05.699	.431	932.0	19 20 04 36.841	36.414
20	258.5	3 56 01.828	02.255	.427	933.0	20 20 00 40.925	40.505
21	259.5	3 59 58.390	58.810	-0.421	934.0	21 19 56 45.009	44.595
22	260.5	4 03 54.952	55.366	.414	935.0	22 19 52 49.093	48.686
23	261.5	4 07 51.514	51.921	.407	936.0	23 19 48 53.179	52.776
24	262.5	4 11 48.073	48.476	.403	937.0	24 19 44 57.268	56.867
25	263.5	4 15 44.630	45.032	.402	938.0	25 19 41 01.359	00.958
26	264.5	4 19 41.184	41.587	-0.403	939.0	26 19 37 05.453	05.048
27	265.5	4 23 37.736	38.142	.406	940.0	27 19 33 09.547	09.139
28	266.5	4 27 34.288	34.698	.410	941.0	28 19 29 13.641	13.229
29	267.5	4 31 30.839	31.253	.414	942.0	29 19 25 17.734	17.320
30	268.5	4 35 27.393	27.808	.416	943.0	30 19 21 21.826	21.410
Dec. 1	269.5	4 39 23.947	24.364	-0.416	944.0	Dec. 1 19 17 25.915	25.501
2	270.5	4 43 20.504	20.919	.415	945.0	2 19 13 30.003	29.591
3	271.5	4 47 17.063	17.475	.412	946.0	3 19 09 34.089	33.682
4	272.5	4 51 13.622	14.030	.408	947.0	4 19 05 38.175	37.772
5	273.5	4 55 10.183	10.585	.403	948.0	5 19 01 42.261	41.863
6	274.5	4 59 06.743	07.141	-0.398	949.0	6 18 57 46.347	45.953
7	275.5	5 03 03.302	03.696	.394	950.0	7 18 53 50.434	50.044
8	276.5	5 06 59.861	60.251	.391	951.0	8 18 49 54.523	54.134
9	277.5	5 10 56.417	56.807	.389	952.0	9 18 45 58.613	58.225
10	278.5	5 14 52.972	53.362	.390	953.0	10 18 42 02.705	02.316
11	279.5	5 18 49.526	49.917	-0.391	954.0	11 18 38 06.798	06.406
12	280.5	5 22 46.079	46.473	.394	955.0	12 18 34 10.892	10.497
13	281.5	5 26 42.631	43.028	.397	956.0	13 18 30 14.985	14.587
14	282.5	5 30 39.184	39.584	.399	957.0	14 18 26 19.077	18.678
15	283.5	5 34 35.739	36.139	.400	958.0	15 18 22 23.166	22.768
16	284.5	5 38 32.296	32.694	-0.398	959.0	16 18 18 27.253	26.859
17	285.5	5 42 28.856	29.250	.394	960.0	17 18 14 31.336	30.949
18	286.5	5 46 25.419	25.805	.386	961.0	18 18 10 35.418	35.040
19	287.5	5 50 21.983	22.360	.377	962.0	19 18 06 39.500	39.130
20	288.5	5 54 18.547	18.916	.369	963.0	20 18 02 43.583	43.221
21	289.5	5 58 15.109	15.471	-0.362	964.0	21 17 58 47.669	47.311
22	290.5	6 02 11.669	12.026	.358	965.0	22 17 54 51.758	51.402
23	291.5	6 06 08.225	08.582	.357	966.0	23 17 50 55.849	55.493
24	292.5	6 10 04.779	05.137	.358	967.0	24 17 46 59.942	59.583
25	293.5	6 14 01.331	01.693	.361	968.0	25 17 43 04.036	03.674
26	294.5	6 17 57.884	58.248	-0.364	969.0	26 17 39 08.128	07.764
27	295.5	6 21 54.438	54.803	.366	970.0	27 17 35 12.220	11.855
28	296.5	6 25 50.993	51.359	.366	971.0	28 17 31 16.309	15.945
29	297.5	6 29 47.550	47.914	.364	972.0	29 17 27 20.397	20.036
30	298.5	6 33 44.108	44.469	.361	973.0	30 17 23 24.483	24.126
31	299.5	6 37 40.668	41.025	-0.357	974.0	31 17 19 28.569	28.217
32	300.5	6 41 37.229	37.580	-0.351	975.0	32 17 15 32.654	32.307

FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1960.0	Red. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1960.0	1950.0	Date				
									23° 26'
Jan.	0 278° 33' 36".9	—20.8	+0.65	+5.21	+0.65	8.95	—0.185	+0.178	30.254
	1 279 34 47.7	20.6	.58	5.12	.58	8.95	—0.048	0.261	30.294
	2 280 35 58.5	20.4	.49	5.01	.49	8.95	+0.090	0.295	30.337
	3 281 37 09.2	20.3	.37	4.87	.37	8.95	0.228	0.285	30.372
	4 282 38 19.6	20.2	.24	4.72	.24	8.95	0.365	0.246	30.397
	5 283 39 29.7	—20.1	+0.10	+4.55	+0.10	8.95	+0.503	+0.197	30.408
	6 284 40 39.4	20.0	— .02	4.39	— .03	8.95	0.641	0.152	30.405
	7 285 41 48.8	19.9	.14	4.25	.15	8.95	0.778	0.121	30.393
	8 286 42 57.8	19.8	.24	4.12	.25	8.95	0.916	0.113	30.376
	9 287 44 06.3	19.6	.33	3.99	.34	8.95	1.054	0.131	30.358
	10 288 45 14.5	—19.5	—0.40	+3.89	—0.41	8.95	+1.191	+0.172	30.344
	11 289 46 22.2	19.3	.44	3.82	.45	8.95	1.329	0.235	30.339
	12 290 47 29.5	19.0	.45	3.77	.46	8.95	1.466	0.308	30.345
	13 291 48 36.4	18.8	.44	3.75	.45	8.95	1.604	0.382	30.360
	14 292 49 42.8	18.6	.40	3.75	.41	8.95	1.742	0.447	30.389
	15 293 50 48.9	—18.4	—0.32	+3.78	—0.34	8.95	+1.879	+0.493	30.426
	16 294 51 54.6	18.3	.24	3.82	.26	8.95	2.017	0.513	30.469
	17 295 52 59.9	18.2	.13	3.89	.15	8.95	2.155	0.501	30.514
	18 296 54 04.9	18.1	— .01	3.96	— .03	8.95	2.292	0.461	30.552
	19 297 55 09.5	18.0	+ .12	4.05	+ .10	8.94	2.430	0.403	30.580
	20 298 56 13.8	—17.9	+0.25	+4.13	+0.23	8.94	+2.567	+0.337	30.593
	21 299 57 17.7	17.8	.37	4.21	.35	8.94	2.705	0.280	30.593
	22 300 58 21.3	17.7	.47	4.26	.45	8.94	2.843	0.250	30.581
	23 301 59 24.5	17.6	.56	4.30	.54	8.94	2.980	0.256	30.561
	24 303 00 27.3	17.4	.61	4.30	.59	8.94	3.118	0.307	30.545
	25 304 01 29.6	—17.1	+0.64	+4.28	+0.62	8.94	+3.256	+0.395	30.540
	26 305 02 31.4	16.9	.63	4.21	.61	8.94	3.393	0.503	30.553
	27 306 03 32.4	16.7	.59	4.12	.57	8.94	3.531	0.605	30.585
	28 307 04 32.7	16.4	.53	3.99	.50	8.94	3.669	0.675	30.633
	29 308 05 32.2	16.3	.43	3.84	.40	8.93	3.806	0.701	30.689
	30 309 06 30.6	—16.2	+0.31	+3.66	+0.28	8.93	+3.944	+0.678	30.741
	31 310 07 28.0	16.1	.18	3.47	.15	8.93	4.081	0.617	30.783
Feb.	1 311 08 24.1	16.0	+ .05	3.28	+ .02	8.93	4.219	0.536	30.812
	2 312 09 19.0	16.0	— .08	3.09	— .11	8.93	4.357	0.451	30.825
	3 313 10 12.6	15.9	.21	2.90	.24	8.93	4.494	0.377	30.826
	4 314 11 04.8	—15.8	—0.32	+2.73	—0.35	8.93	+4.632	+0.325	30.819
	5 315 11 55.6	15.7	.41	2.57	.44	8.93	4.770	0.297	30.811
	6 316 12 45.0	15.6	.48	2.44	.51	8.92	4.907	0.293	30.803
	7 317 13 32.9	15.4	.53	2.32	.56	8.92	5.045	0.310	30.802
	8 318 14 19.3	15.2	.55	2.23	.58	8.92	5.183	0.341	30.810
	9 319 15 04.3	—15.1	—0.54	+2.18	—0.57	8.92	+5.320	+0.376	30.830
	10 320 15 47.9	14.9	.50	2.15	.53	8.92	5.458	0.404	30.860
	11 321 16 29.9	14.7	.44	2.14	.47	8.92	5.595	0.415	30.900
	12 322 17 10.6	14.6	.36	2.15	.39	8.92	5.733	0.402	30.947
	13 323 17 49.8	14.5	.25	2.19	.28	8.91	5.871	0.358	30.996
	14 324 18 27.6	—14.4	—0.13	+2.24	—0.16	8.91	+6.008	+0.285	31.040
	15 325 19 04.1	—14.4	+0.01	+2.31	—0.02	8.91	+6.146	+0.188	31.074

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

SUN, 1960
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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
	^h ^m ^s	[°] ['] ["]		['] ["]	^m ^s
Jan. 0	18 37 14.65 _{265.52}	-23 09 55.6 _{250.1}	0.983 3048 - 183	16 17.50	- 2 32.88 _{-28.96}
1	18 41 40.17 _{265.22}	23 05 45.5 _{277.7}	.983 2865 ₁₄₄	16 17.52	3 01.84 _{28.66}
2	18 46 05.39 _{264.88}	23 01 07.8 _{305.3}	.983 2721 ₁₀₄	16 17.53	3 30.50 _{28.33}
3	18 50 30.27 _{264.52}	22 56 02.5 _{332.7}	.983 2617 ₆₀	16 17.54	3 58.83 _{27.96}
4	18 54 54.79 _{264.13}	22 50 29.8 _{360.0}	.983 2557 - 14	16 17.55	4 26.79 _{27.58}
5	18 59 18.92 _{263.69}	-22 44 29.8 _{387.0}	0.983 2543 ₃₅	16 17.55	- 4 54.37 _{-27.14}
6	19 03 42.61 _{263.25}	22 38 02.8 _{413.9}	.983 2578 ₈₈	16 17.55	5 21.51 _{26.69}
7	19 08 05.86 _{262.76}	22 31 08.9 _{440.6}	.983 2666 ₁₄₂	16 17.54	5 48.20 _{26.21}
8	19 12 28.62 _{262.27}	22 23 48.3 _{467.0}	.983 2808 ₁₉₈	16 17.52	6 14.41 _{25.71}
9	19 16 50.89 _{261.73}	22 16 01.3 _{493.3}	.983 3006 ₂₅₆	16 17.50	6 40.12 _{25.18}
10	19 21 12.62 _{261.19}	-22 07 48.0 _{519.2}	0.983 3262 ₃₁₇	16 17.48	- 7 05.30 _{-24.62}
11	19 25 33.81 _{260.61}	21 59 08.8 _{545.0}	.983 3579 ₃₇₈	16 17.45	7 29.92 _{24.05}
12	19 29 54.42 _{260.01}	21 50 03.8 _{570.4}	.983 3957 ₄₃₉	16 17.41	7 53.97 _{23.46}
13	19 34 14.43 _{259.41}	21 40 33.4 _{595.6}	.983 4396 ₅₀₂	16 17.37	8 17.43 _{22.84}
14	19 38 33.84 _{258.77}	21 30 37.8 _{620.6}	.983 4898 ₅₆₆	16 17.32	8 40.27 _{22.22}
15	19 42 52.61 _{258.12}	-21 20 17.2 _{645.2}	0.983 5464 ₆₂₈	16 17.26	- 9 02.49 _{-21.56}
16	19 47 10.73 _{257.46}	21 09 32.0 _{666.6}	.983 6092 ₆₈₉	16 17.20	9 24.05 _{20.90}
17	19 51 28.19 _{256.78}	20 58 22.4 _{693.6}	.983 6781 ₇₅₂	16 17.13	9 44.95 _{20.23}
18	19 55 44.97 _{256.09}	20 46 48.8 _{717.3}	.983 7533 ₈₁₀	16 17.05	10 05.18 _{19.54}
19	20 00 01.06 _{255.38}	20 34 51.5 _{740.8}	.983 8343 ₈₆₆	16 16.97	10 24.72 _{18.83}
20	20 04 16.44 _{254.68}	-20 22 30.7 _{763.8}	0.983 9209 ₉₂₁	16 16.89	-10 43.55 _{-18.12}
21	20 08 31.12 _{253.94}	20 09 46.9 _{786.7}	.984 0130 ₉₇₂	16 16.80	11 01.67 _{17.40}
22	20 12 45.06 _{253.22}	19 56 40.2 _{809.0}	.984 1102 ₁₀₁₉	16 16.70	11 19.07 _{16.65}
23	20 16 58.28 _{252.46}	19 43 11.2 _{831.0}	.984 2121 ₁₀₆₂	16 16.60	11 35.72 _{15.91}
24	20 21 10.74 _{251.71}	19 29 20.2 _{852.7}	.984 3183 ₁₁₀₂	16 16.49	11 51.63 _{15.15}
25	20 25 22.45 _{250.94}	-19 15 07.5 _{874.0}	0.984 4285 ₁₁₃₉	16 16.38	-12 06.78 _{-14.38}
26	20 29 33.39 _{250.15}	19 00 33.5 _{894.9}	.984 5424 ₁₁₇₂	16 16.27	12 21.16 _{13.58}
27	20 33 43.54 _{249.35}	18 45 38.6 _{915.3}	.984 6596 ₁₂₀₅	16 16.15	12 34.74 _{12.80}
28	20 37 52.89 _{248.54}	18 30 23.3 _{935.5}	.984 7801 ₁₂₃₅	16 16.04	12 47.54 _{11.98}
29	20 42 01.43 _{247.73}	18 14 47.8 _{955.1}	.984 9036 ₁₂₆₆	16 15.91	12 59.52 _{11.17}
30	20 46 09.16 _{246.90}	-17 58 52.7 _{974.4}	0.985 0302 ₁₂₉₉	16 15.79	-13 10.69 _{-10.35}
31	20 50 16.06 _{246.06}	17 42 38.3 _{993.3}	.985 1601 ₁₃₃₂	16 15.66	13 21.04 _{9.51}
Feb. 1	20 54 22.12 _{245.23}	17 26 05.0 _{1011.7}	.985 2933 ₁₃₆₇	16 15.53	13 30.55 _{8.68}
2	20 58 27.35 _{244.39}	17 09 13.3 _{1029.9}	.985 4300 ₁₄₀₅	16 15.39	13 39.23 _{7.84}
3	21 02 31.74 _{243.56}	16 52 03.4 _{1047.5}	.985 5705 ₁₄₄₅	16 15.25	13 47.07 _{7.01}
4	21 06 35.30 _{242.72}	-16 34 35.9 _{1064.8}	0.985 7150 ₁₄₈₇	16 15.11	-13 54.08 _{- 6.17}
5	21 10 38.02 _{241.89}	16 16 51.1 _{1081.6}	.985 8637 ₁₅₃₁	16 14.96	14 00.25 _{5.34}
6	21 14 39.91 _{241.07}	15 58 49.5 _{1098.0}	.986 0168 ₁₅₇₇	16 14.81	14 05.59 _{4.51}
7	21 18 40.98 _{240.25}	15 40 31.5 _{1114.1}	.986 1745 ₁₆₂₃	16 14.66	14 10.10 _{3.69}
8	21 22 41.23 _{239.43}	15 21 57.4 _{1129.6}	.986 3368 ₁₆₇₂	16 14.49	14 13.79 _{2.88}
9	21 26 40.66 _{238.63}	-15 03 07.8 _{1144.9}	0.986 5040 ₁₇₂₃	16 14.33	-14 16.67 _{- 2.07}
10	21 30 39.29 _{237.83}	14 44 02.9 _{1159.6}	.986 6763 ₁₇₇₂	16 14.16	14 18.74 _{1.27}
11	21 34 37.12 _{237.05}	14 24 43.3 _{1174.0}	.986 8535 ₁₈₂₄	16 13.98	14 20.01 _{- 0.49}
12	21 38 34.17 _{236.27}	14 05 09.3 _{1187.9}	.987 0359 ₁₈₇₆	16 13.80	14 20.50 _{+ 0.28}
13	21 42 30.44 _{235.51}	13 45 21.4 _{1201.6}	.987 2235 ₁₉₂₈	16 13.62	14 20.22 _{+ 1.04}
14	21 46 25.95 _{234.76}	-13 25 19.8 _{1214.7}	0.987 4163 ₁₉₇₈	16 13.43	-14 19.18 _{+ 1.79}
15	21 50 20.71	-13 05 05.1	0.987 6141	16 13.23	-14 17.39

SUN, 1960

FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1960.0	Red. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1960.0	1950.0	Date				
									23° 26'
Feb. 15	325 19 04.1 3635.2	-14.4	+0.01	+2.31	-0.02	8.91	+ 6.146	+0.188	31.074
16	326 19 39.3 3633.9	14.4	.14	2.36	+ .11	8.91	6.284	+0.079	31.094
17	327 20 13.2 3632.6	14.3	.27	2.42	.24	8.91	6.421	-0.023	31.098
18	328 20 45.8 3631.3	14.3	.38	2.45	.35	8.90	6.559	0.105	31.090
19	329 21 17.1 3630.2	14.2	.48	2.48	.45	8.90	6.697	0.153	31.072
20	330 21 47.3 3628.8	-14.0	+0.55	+2.47	+0.52	8.90	+ 6.834	-0.161	31.056
21	331 22 16.1 3627.6	13.9	.58	2.43	.55	8.90	6.972	0.132	31.045
22	332 22 43.7 3626.2	13.7	.59	2.36	.56	8.90	7.109	0.079	31.051
23	333 23 09.9 3624.8	13.5	.55	2.25	.53	8.89	7.247	-0.024	31.073
24	334 23 34.7 3623.4	13.3	.48	2.10	.46	8.89	7.385	+0.011	31.111
25	335 23 58.1 3621.8	-13.1	+0.38	+1.93	+0.36	8.89	+ 7.522	+0.010	31.159
26	336 24 19.9 3620.1	13.1	.27	1.74	.25	8.89	7.660	-0.038	31.210
27	337 24 40.0 3618.4	13.0	+ .14	1.53	+ .12	8.89	7.798	0.125	31.252
28	338 24 58.4 3616.5	13.0	.00	1.31	- .02	8.88	7.935	0.241	31.279
29	339 25 14.9 3614.6	13.0	- .13	1.10	.15	8.88	8.073	0.367	31.292
Mar. 1	340 25 29.5 3612.7	-12.9	-0.26	+0.89	-0.28	8.88	+ 8.210	-0.486	31.291
2	341 25 42.2 3610.6	12.9	.38	0.68	.40	8.88	8.348	0.586	31.278
3	342 25 52.8 3608.6	12.8	.48	0.50	.50	8.88	8.486	0.661	31.261
4	343 26 01.4 3606.5	12.7	.56	0.34	.58	8.87	8.623	0.709	31.244
5	344 26 07.9 3604.3	12.6	.61	0.21	.63	8.87	8.761	0.734	31.231
6	345 26 12.2 3602.2	-12.5	-0.64	+0.11	-0.65	8.87	+ 8.899	-0.744	31.226
7	346 26 14.4 3600.1	12.3	.64	+0.02	.65	8.87	9.036	0.744	31.231
8	347 26 14.5 3598.0	12.2	.61	-0.03	.62	8.86	9.174	0.747	31.247
9	348 26 12.5 3595.8	12.1	.55	0.05	.56	8.86	9.312	0.762	31.272
10	349 26 08.3 3593.7	12.0	.46	0.05	.47	8.86	9.449	0.798	31.305
11	350 26 02.0 3591.7	-11.9	-0.36	-0.03	-0.37	8.86	+ 9.587	-0.862	31.341
12	351 25 53.7 3589.6	11.8	.25	+0.01	.25	8.86	9.724	0.956	31.375
13	352 25 43.3 3587.6	11.8	- .11	0.07	- .11	8.85	9.862	1.073	31.399
14	353 25 30.9 3585.7	11.8	+ .02	0.11	+ .02	8.85	10.000	1.208	31.411
15	354 25 16.6 3583.9	11.8	.15	0.16	.15	8.85	10.137	1.340	31.407
16	355 25 00.5 3582.0	-11.8	+0.28	+0.20	+0.28	8.85	+10.275	-1.454	31.385
17	356 24 42.5 3580.3	11.7	.38	0.22	.38	8.84	10.413	1.535	31.355
18	357 24 22.8 3578.5	11.6	.45	0.21	.45	8.84	10.550	1.573	31.322
19	358 24 01.3 3576.8	11.4	.49	0.17	.50	8.84	10.688	1.572	31.295
20	359 23 38.1 3575.1	11.3	.51	0.11	.52	8.84	10.826	1.546	31.279
21	0 23 13.2 3573.4	-11.1	+0.49	+0.01	+0.50	8.83	+10.963	-1.513	31.281
22	1 22 46.6 3571.7	10.9	.43	-0.13	.44	8.83	11.101	1.494	31.300
23	2 22 18.3 3569.9	10.8	.34	0.31	.35	8.83	11.238	1.505	31.328
24	3 21 48.2 3568.0	10.7	.22	0.50	.24	8.82	11.376	1.557	31.361
25	4 21 16.2 3566.2	10.7	+ .10	0.70	+ .12	8.82	11.514	1.647	31.389
26	5 20 42.4 3564.2	-10.6	-0.03	-0.91	-0.01	8.82	+11.651	-1.768	31.405
27	6 20 06.6 3562.1	10.6	.17	1.14	.15	8.82	11.789	1.904	31.405
28	7 19 28.7 3560.1	10.6	.32	1.36	.29	8.81	11.927	2.036	31.392
29	8 18 48.8 3557.9	10.6	.44	1.56	.41	8.81	12.064	2.153	31.366
30	9 18 06.7 3555.8	10.5	.54	1.74	.51	8.81	12.202	2.245	31.332
31	10 17 22.5 3553.5	-10.5	-0.62	-1.90	-0.59	8.81	+12.340	-2.307	31.296
Apr. 1	11 16 36.0	-10.3	-0.68	-2.04	-0.65	8.80	+12.477	-2.343	31.263

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
	^h ^m ^s	[°] ['] ["]		['] ["]	^m ^s
Feb. 15	21 50 20.71 ^s	-13 05 05.1	0.987 6141	16 13.23	-14 17.39
16	21 54 14.75 ^{234.04}	12 44 37.6 ^{+1227.5}	.987 8169 ⁺²⁰²⁸	16 13.03	14 14.88 ^{+2.51}
17	21 58 08.06 ^{233.31}	12 23 57.7 ^{1239.9}	.988 0245 ²⁰⁷⁶	16 12.83	14 11.65 ^{3.23}
18	22 02 00.68 ^{232.62}	12 03 05.9 ^{1251.8}	.988 2365 ²¹²⁰	16 12.62	14 07.72 ^{3.93}
19	22 05 52.62 ^{231.94}	11 42 02.4 ^{1263.5}	.988 4526 ²¹⁶¹	16 12.41	14 03.10 ^{4.62}
	231.27	1274.6	2199		5.28
20	22 09 43.89 ^{230.62}	-11 20 47.8 ^{+1285.4}	0.988 6725 ⁺²²³³	16 12.19	-13 57.82 ^{+5.94}
21	22 13 34.51 ^{229.98}	10 59 22.4 ^{1295.7}	.988 8958 ²²⁶²	16 11.97	13 51.88 ^{6.58}
22	22 17 24.49 ^{229.35}	10 37 46.7 ^{1305.7}	.989 1220 ²²⁸⁸	16 11.75	13 45.30 ^{7.21}
23	22 21 13.84 ^{228.74}	10 16 01.0 ^{1315.1}	.989 3508 ²³¹⁰	16 11.53	13 38.09 ^{7.82}
24	22 25 02.58 ^{228.13}	9 54 05.9 ^{1324.1}	.989 5818 ²³³⁰	16 11.30	13 30.27 ^{8.42}
25	22 28 50.71 ^{227.54}	-9 32 01.8 ^{+1332.9}	0.989 8148 ⁺²³⁴⁵	16 11.07	-13 21.85 ^{+9.02}
26	22 32 38.25 ^{226.95}	9 09 48.9 ^{1341.0}	.990 0493 ²³⁶⁰	16 10.84	13 12.83 ^{9.59}
27	22 36 25.20 ^{226.39}	8 47 27.9 ^{1348.8}	.990 2853 ²³⁷⁵	16 10.61	13 03.24 ^{10.16}
28	22 40 11.59 ^{225.84}	8 24 59.1 ^{1356.3}	.990 5228 ²³⁸⁹	16 10.38	12 53.08 ^{10.71}
29	22 43 57.43 ^{225.29}	8 02 22.8 ^{1363.2}	.990 7617 ²⁴⁰⁴	16 10.14	12 42.37 ^{11.26}
Mar. 1	22 47 42.72 ^{224.77}	-7 39 39.6 ^{+1369.8}	0.991 0021 ⁺²⁴²¹	16 09.91	-12 31.11 ^{+11.77}
2	22 51 27.49 ^{224.27}	7 16 49.8 ^{1375.9}	.991 2442 ²⁴³⁸	16 09.67	12 19.34 ^{12.29}
3	22 55 11.76 ^{223.77}	6 53 53.9 ^{1381.7}	.991 4880 ²⁴⁵⁷	16 09.43	12 07.05 ^{12.78}
4	22 58 55.53 ^{223.31}	6 30 52.2 ^{1387.1}	.991 7337 ²⁴⁷⁸	16 09.19	11 54.27 ^{13.25}
5	23 02 38.84 ^{222.85}	6 07 45.1 ^{1392.1}	.991 9815 ²⁵⁰¹	16 08.95	11 41.02 ^{13.70}
6	23 06 21.69 ^{222.42}	-5 44 33.0 ^{+1396.7}	0.992 2316 ⁺²⁵²⁵	16 08.71	-11 27.32 ^{+14.14}
7	23 10 04.11 ^{221.99}	5 21 16.3 ^{1400.8}	.992 4841 ²⁵⁵⁰	16 08.46	11 13.18 ^{14.56}
8	23 13 46.10 ^{221.61}	4 57 55.5 ^{1404.7}	.992 7391 ²⁵⁷⁶	16 08.21	10 58.62 ^{14.94}
9	23 17 27.71 ^{221.23}	4 34 30.8 ^{1408.1}	.992 9967 ²⁶⁰⁴	16 07.96	10 43.68 ^{15.32}
10	23 21 08.94 ^{220.88}	4 11 02.7 ^{1411.2}	.993 2571 ²⁶³³	16 07.71	10 28.36 ^{15.68}
11	23 24 49.82 ^{220.55}	-3 47 31.5 ^{+1413.8}	0.993 5204 ⁺²⁶⁶⁴	16 07.45	-10 12.68 ^{+16.00}
12	23 28 30.37 ^{220.24}	3 23 57.7 ^{1416.2}	.993 7868 ²⁶⁹⁵	16 07.19	9 56.68 ^{16.30}
13	23 32 10.61 ^{219.96}	3 00 21.5 ^{1418.2}	.994 0563 ²⁷²⁶	16 06.93	9 40.38 ^{16.59}
14	23 35 50.57 ^{219.71}	2 36 43.3 ^{1419.8}	.994 3289 ²⁷⁵⁷	16 06.66	9 23.79 ^{16.84}
15	23 39 30.28 ^{219.47}	2 13 03.5 ^{1421.1}	.994 6046 ²⁷⁸⁵	16 06.39	9 06.95 ^{17.08}
16	23 43 09.75 ^{219.27}	-1 49 22.4 ^{+1422.1}	0.994 8831 ⁺²⁸¹²	16 06.12	-8 49.87 ^{+17.28}
17	23 46 49.02 ^{219.09}	1 25 40.3 ^{1422.6}	.995 1643 ²⁸³⁵	16 05.85	8 32.59 ^{17.46}
18	23 50 28.11 ^{218.94}	1 01 57.7 ^{1422.9}	.995 4478 ²⁸⁵⁶	16 05.58	8 15.13 ^{17.62}
19	23 54 07.05 ^{218.79}	0 38 14.8 ^{1422.8}	.995 7334 ²⁸⁷¹	16 05.30	7 57.51 ^{17.76}
20	23 57 45.84 ^{218.68}	-0 14 32.0 ^{1422.3}	.996 0205 ²⁸⁸⁴	16 05.02	7 39.75 ^{17.88}
21	0 01 24.52 ^{218.59}	+0 09 10.3 ^{+1421.4}	0.996 3089 ⁺²⁸⁹²	16 04.74	-7 21.87 ^{+17.97}
22	0 05 03.11 ^{218.50}	0 32 51.7 ^{1420.2}	.996 5981 ²⁸⁹⁶	16 04.46	7 03.90 ^{18.05}
23	0 08 41.61 ^{218.45}	0 56 31.9 ^{1418.6}	.996 8877 ²⁸⁹⁵	16 04.18	6 45.85 ^{18.11}
24	0 12 20.06 ^{218.40}	1 20 10.5 ^{1416.7}	.997 1772 ²⁸⁹²	16 03.90	6 27.74 ^{18.15}
25	0 15 58.46 ^{218.37}	1 43 47.2 ^{1414.3}	.997 4664 ²⁸⁸⁶	16 03.62	6 09.59 ^{18.17}
26	0 19 36.83 ^{218.37}	+2 07 21.5 ^{+1411.5}	0.997 7550 ⁺²⁸⁷⁸	16 03.34	-5 51.42 ^{+18.19}
27	0 23 15.20 ^{218.37}	2 30 53.0 ^{1408.5}	.998 0428 ²⁸⁷⁰	16 03.06	5 33.23 ^{18.17}
28	0 26 53.57 ^{218.39}	2 54 21.5 ^{1405.1}	.998 3298 ²⁸⁵⁹	16 02.79	5 15.06 ^{18.16}
29	0 30 31.96 ^{218.44}	3 17 46.6 ^{1401.2}	.998 6157 ²⁸⁵¹	16 02.51	4 56.90 ^{18.11}
30	0 34 10.40 ^{218.49}	3 41 07.8 ^{1397.1}	.998 9008 ²⁸⁴²	16 02.24	4 38.79 ^{18.06}
31	0 37 48.89 ^{218.56}	+4 04 24.9 ^{+1392.6}	0.999 1850 ⁺²⁸³⁵	16 01.96	-4 20.73 ^{+17.99}
Apr. 1	0 41 27.45	+4 27 37.5	0.999 4685	16 01.69	-4 02.74

SUN, 1960
FOR 0^h EPHEMERIS TIME

Date	Longitude		Red. to App. Long.	Latitude			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic	
	Mean Equinox of 1960.0			Ecliptic of							
				1960.0	1950.0	Date					
										23° 26'	
Apr.	1	11 16 36.0	3551.2	-10.3	-0.68	-2.04	-0.65	8.80	+12.477	-2.343	31.263
	2	12 15 47.2	3548.9	10.2	.72	2.15	.68	8.80	12.615	2.358	31.239
	3	13 14 56.1	3546.7	10.1	.72	2.23	.68	8.80	12.752	2.362	31.221
	4	14 14 02.8	3544.3	9.9	.70	2.29	.66	8.80	12.890	2.363	31.216
	5	15 13 07.1	3542.1	9.8	.65	2.32	.61	8.79	13.028	2.373	31.222
	6	16 12 09.2	3539.7	- 9.7	-0.58	-2.32	-0.54	8.79	+13.165	-2.399	31.235
	7	17 11 08.9	3537.5	9.6	.49	2.30	.44	8.79	13.303	2.449	31.253
	8	18 10 06.4	3535.3	9.5	.36	2.25	.31	8.79	13.441	2.525	31.271
	9	19 09 01.7	3533.0	9.5	.23	2.19	.18	8.78	13.578	2.629	31.282
	10	20 07 54.7	3530.9	9.5	- .11	2.15	- .06	8.78	13.716	2.750	31.282
	11	21 06 45.6	3528.9	- 9.4	+0.01	-2.09	+0.07	8.78	+13.853	-2.876	31.267
	12	22 05 34.5	3526.8	9.4	.14	2.04	.20	8.78	13.991	2.987	31.235
	13	23 04 21.3	3525.0	9.3	.25	2.00	.31	8.77	14.129	3.066	31.190
	14	24 03 06.3	3523.1	9.2	.32	2.00	.39	8.77	14.266	3.100	31.137
	15	25 01 49.4	3521.4	9.1	.38	2.01	.45	8.77	14.404	3.090	31.091
	16	26 00 30.8	3519.7	- 8.9	+0.41	-2.05	+0.48	8.77	+14.542	-3.046	31.057
	17	26 59 10.5	3518.1	8.7	.40	2.13	.47	8.76	14.679	2.990	31.039
	18	27 57 48.6	3516.4	8.5	.34	2.25	.42	8.76	14.817	2.945	31.040
	19	28 56 25.0	3514.8	8.4	.27	2.39	.35	8.76	14.955	2.928	31.053
	20	29 54 59.8	3513.1	8.2	.17	2.56	.25	8.76	15.092	2.950	31.071
	21	30 53 32.9	3511.5	- 8.2	+0.05	-2.75	+0.13	8.76	+15.230	-3.011	31.085
	22	31 52 04.4	3509.9	8.1	- .09	2.94	.00	8.75	15.367	3.103	31.092
	23	32 50 34.3	3508.1	8.1	.22	3.14	- .13	8.75	15.505	3.211	31.084
	24	33 49 02.4	3506.3	8.0	.35	3.33	.26	8.75	15.643	3.323	31.061
	25	34 47 28.7	3504.6	8.0	.47	3.52	.38	8.75	15.780	3.420	31.026
	26	35 45 53.3	3502.6	- 7.9	-0.59	-3.69	-0.49	8.74	+15.918	-3.493	30.982
	27	36 44 15.9	3500.9	7.8	.68	3.84	.58	8.74	16.056	3.538	30.935
	28	37 42 36.8	3498.9	7.7	.74	3.96	.64	8.74	16.193	3.553	30.889
	29	38 40 55.7	3496.9	7.5	.79	4.07	.68	8.74	16.331	3.546	30.851
	30	39 39 12.6	3495.0	7.4	.80	4.13	.69	8.73	16.469	3.521	30.822
May	1	40 37 27.6	3493.1	- 7.2	-0.78	-4.17	-0.67	8.73	+16.606	-3.491	30.803
	2	41 35 40.7	3491.0	7.0	.74	4.18	.62	8.73	16.744	3.466	30.796
	3	42 33 51.7	3489.1	6.9	.67	4.17	.55	8.73	16.881	3.453	30.799
	4	43 32 00.8	3487.1	6.7	.58	4.13	.46	8.73	17.019	3.463	30.807
	5	44 30 07.9	3485.2	6.6	.47	4.08	.35	8.72	17.157	3.498	30.817
	6	45 28 13.1	3483.2	- 6.6	-0.36	-4.01	-0.23	8.72	+17.294	-3.558	30.824
	7	46 26 16.3	3481.3	6.5	.22	3.92	- .09	8.72	17.432	3.639	30.823
	8	47 24 17.6	3479.5	6.4	- .09	3.84	+ .04	8.72	17.570	3.729	30.808
	9	48 22 17.1	3477.8	6.4	+ .03	3.77	.16	8.72	17.707	3.814	30.777
	10	49 20 14.9	3476.1	6.3	.13	3.71	.27	8.71	17.845	3.873	30.731
	11	50 18 11.0	3474.4	- 6.2	+0.22	-3.67	+0.36	8.71	+17.983	-3.889	30.675
	12	51 16 05.4	3473.1	6.0	.29	3.65	.43	8.71	18.120	3.856	30.620
	13	52 13 58.5	3471.6	5.8	.32	3.66	.46	8.71	18.258	3.778	30.577
	14	53 11 50.1	3470.4	5.5	.31	3.71	.46	8.71	18.395	3.677	30.550
	15	54 09 40.5	3469.1	5.3	.28	3.78	.43	8.70	18.533	3.579	30.545
	16	55 07 29.6	3468.0	- 5.1	+0.21	-3.89	+0.36	8.70	+18.671	-3.509	30.553
	17	56 05 17.6		- 4.9	+0.11	-4.02	+0.27	8.70	+18.808	-3.480	30.570

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
	^h ^m ^s	[°] ['] ["]		['] ["]	^m ^s
Apr. 1	0 41 27.45 ^s _{218.66}	+ 4 27 37.5 ["] _{+1387.6}	0.999 4685 ₊₂₈₂₈	16 01.69	- 4 02.74 ^s _{+17.90}
2	0 45 06.11 _{218.76}	4 50 45.1 _{1382.4}	0.999 7513 ₂₈₂₄	16 01.42	3 44.84 _{17.79}
3	0 48 44.87 _{218.89}	5 13 47.5 _{1376.7}	1.000 0337 ₂₈₁₉	16 01.15	3 27.05 _{17.66}
4	0 52 23.76 _{219.04}	5 36 44.2 _{1370.9}	.000 3156 ₂₈₁₆	16 00.88	3 09.39 _{17.52}
5	0 56 02.80 _{219.19}	5 59 35.1 _{1364.5}	.000 5972 ₂₈₁₅	16 00.61	2 51.87 _{17.36}
6	0 59 41.99 _{219.38}	+ 6 22 19.6 _{+1357.8}	1.000 8787 ₊₂₈₁₅	16 00.34	- 2 34.51 _{+17.18}
7	1 03 21.37 _{219.57}	6 44 57.4 _{1350.9}	.001 1602 ₂₈₁₇	16 00.07	2 17.33 _{16.98}
8	1 07 00.94 _{219.79}	7 07 28.3 _{1343.6}	.001 4419 ₂₈₂₂	15 59.80	2 00.35 _{16.76}
9	1 10 40.73 _{220.03}	7 29 51.9 _{1335.8}	.001 7241 ₂₈₂₆	15 59.53	1 43.59 _{16.52}
10	1 14 20.76 _{220.29}	7 52 07.7 _{1327.9}	.002 0067 ₂₈₃₃	15 59.26	1 27.07 _{16.26}
11	1 18 01.05 _{220.57}	+ 8 14 15.6 _{+1319.6}	1.002 2900 ₊₂₈₄₀	15 58.98	- 1 10.81 _{+15.97}
12	1 21 41.62 _{220.87}	8 36 15.2 _{1311.0}	.002 5740 ₂₈₄₇	15 58.71	0 54.84 _{15.68}
13	1 25 22.49 _{221.20}	8 58 06.2 _{1302.1}	.002 8587 ₂₈₅₁	15 58.44	0 39.16 _{15.35}
14	1 29 03.69 _{221.55}	9 19 48.3 _{1292.8}	.003 1438 ₂₈₅₅	15 58.17	0 23.81 _{15.01}
15	1 32 45.24 _{221.91}	9 41 21.1 _{1283.3}	.003 4293 ₂₈₅₆	15 57.90	- 0 08.80 _{14.65}
16	1 36 27.15 _{222.29}	+ 10 02 44.4 _{+1273.4}	1.003 7149 ₊₂₈₅₁	15 57.62	+ 0 05.85 _{+14.26}
17	1 40 09.44 _{222.70}	10 23 57.8 _{1263.2}	.004 0000 ₂₈₄₅	15 57.35	0 20.11 _{13.87}
18	1 43 52.14 _{223.10}	10 45 01.0 _{1252.6}	.004 2845 ₂₈₃₄	15 57.08	0 33.98 _{13.45}
19	1 47 35.24 _{223.53}	11 05 53.6 _{1241.8}	.004 5679 ₂₈₁₈	15 56.81	0 47.43 _{13.03}
20	1 51 18.77 _{223.96}	11 26 35.4 _{1230.5}	.004 8497 ₂₇₉₈	15 56.54	1 00.46 _{12.59}
21	1 55 02.73 _{224.42}	+ 11 47 05.9 _{+1219.0}	1.005 1295 ₊₂₇₇₅	15 56.27	+ 1 13.05 _{+12.13}
22	1 58 47.15 _{224.87}	12 07 24.9 _{1207.0}	.005 4070 ₂₇₄₈	15 56.01	1 25.18 _{11.68}
23	2 02 32.02 _{225.34}	12 27 31.9 _{1194.9}	.005 6818 ₂₇₂₁	15 55.75	1 36.86 _{11.20}
24	2 06 17.36 _{225.82}	12 47 26.8 _{1182.2}	.005 9539 ₂₆₉₀	15 55.49	1 48.06 _{10.73}
25	2 10 03.18 _{226.31}	13 07 09.0 _{1169.4}	.006 2229 ₂₆₅₇	15 55.24	1 58.79 _{10.25}
26	2 13 49.49 _{226.80}	+ 13 26 38.4 _{+1156.1}	1.006 4886 ₊₂₆₂₅	15 54.98	+ 2 09.04 _{+ 9.75}
27	2 17 36.29 _{227.29}	13 45 54.5 _{1142.5}	.006 7511 ₂₅₉₂	15 54.73	2 18.79 _{9.26}
28	2 21 23.58 _{227.80}	14 04 57.0 _{1128.6}	.007 0103 ₂₅₅₉	15 54.49	2 28.05 _{8.76}
29	2 25 11.38 _{228.32}	14 25 45.6 _{1114.3}	.007 2662 ₂₅₂₈	15 54.25	2 36.81 _{8.24}
30	2 28 59.70 _{228.83}	14 42 19.9 _{1099.8}	.007 5190 ₂₄₉₆	15 54.01	2 45.05 _{7.73}
May 1	2 32 48.53 _{229.34}	+ 15 00 39.7 _{+1084.9}	1.007 7686 ₊₂₄₆₇	15 53.77	+ 2 52.78 _{+ 7.21}
2	2 36 37.87 _{229.88}	15 18 44.6 _{1069.6}	.008 0153 ₂₄₃₇	15 53.54	2 59.99 _{6.68}
3	2 40 27.75 _{230.40}	15 36 34.2 _{1054.1}	.008 2590 ₂₄₁₀	15 53.31	3 06.67 _{6.15}
4	2 44 18.15 _{230.94}	15 54 08.3 _{1038.2}	.008 5000 ₂₃₈₅	15 53.08	3 12.82 _{5.62}
5	2 48 09.09 _{231.48}	16 11 26.5 _{1022.0}	.008 7385 ₂₃₆₁	15 52.85	3 18.44 _{5.07}
6	2 52 00.57 _{232.01}	+ 16 28 28.5 _{+1005.5}	1.008 9746 ₊₂₃₃₈	15 52.63	+ 3 23.51 _{+ 4.53}
7	2 55 52.58 _{232.58}	16 45 14.0 _{988.7}	.009 2084 ₂₃₂₀	15 52.41	3 28.04 _{3.98}
8	2 59 45.16 _{233.12}	17 01 42.7 _{971.7}	.009 4404 ₂₃₀₁	15 52.19	3 32.02 _{3.43}
9	3 03 38.28 _{233.69}	17 17 54.4 _{954.2}	.009 6705 ₂₂₈₇	15 51.97	3 35.45 _{2.86}
10	3 07 31.97 _{234.26}	17 33 48.6 _{936.6}	.009 8992 ₂₂₇₂	15 51.76	3 38.31 _{2.29}
11	3 11 26.23 _{234.83}	+ 17 49 25.2 _{+ 918.7}	1.010 1264 ₊₂₂₅₈	15 51.54	+ 3 40.60 _{+ 1.73}
12	3 15 21.06 _{235.42}	18 04 43.9 _{900.5}	.010 3522 ₂₂₄₃	15 51.33	3 42.33 _{1.14}
13	3 19 16.48 _{235.99}	18 19 44.4 _{882.0}	.010 5765 ₂₂₂₆	15 51.12	3 43.47 _{+ 0.57}
14	3 23 12.47 _{236.59}	18 34 26.4 _{863.3}	.010 7991 ₂₂₀₇	15 50.91	3 44.04 _{- 0.02}
15	3 27 09.06 _{237.16}	18 48 49.7 _{844.3}	.011 0198 ₂₁₈₃	15 50.70	3 44.02 _{0.61}
16	3 31 06.22 _{237.75}	+ 19 02 54.0 _{+ 825.0}	1.011 2381 ₊₂₁₅₇	15 50.50	+ 3 43.41 _{- 1.19}
17	3 35 03.97	+ 19 16 39.0	1.011 4538	15 50.30	+ 3 42.22

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Date	Longitude Mean Equinox of 1960.0	Red. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1960.0	1950.0	Date				
									23° 26'
May 17	56° 05' 17.6 3466.9	- 4.9	+0.11	-4.02	+0.27	8.70	+18.808	-3.480	30.570
18	57 03 04.5 3465.8	4.8	.00	4.17	.16	8.70	18.946	3.492	30.589
19	58 00 50.3 3464.6	4.7	- .13	4.34	+ .03	8.70	19.084	3.542	30.597
20	58 58 34.9 3463.6	4.6	.26	4.51	- .10	8.69	19.221	3.610	30.594
21	59 56 18.5 3462.5	4.5	.40	4.67	.23	8.69	19.359	3.685	30.577
22	60 54 01.0 3461.4	- 4.5	-0.52	-4.83	-0.35	8.69	+19.497	-3.750	30.547
23	61 51 42.4 3460.2	4.4	.62	4.96	.45	8.69	19.634	3.795	30.507
24	62 49 22.6 3459.0	4.2	.71	5.09	.54	8.69	19.772	3.811	30.463
25	63 47 01.6 3457.9	4.1	.78	5.19	.61	8.69	19.909	3.799	30.421
26	64 44 39.5 3456.6	3.9	.83	5.26	.65	8.69	20.047	3.760	30.383
27	65 42 16.1 3455.4	- 3.7	-0.84	-5.29	-0.66	8.68	+20.185	-3.705	30.355
28	66 39 51.5 3454.1	3.5	.82	5.30	.64	8.68	20.322	3.641	30.338
29	67 37 25.6 3452.8	3.3	.78	5.29	.60	8.68	20.460	3.578	30.334
30	68 34 58.4 3451.6	3.1	.72	5.25	.54	8.68	20.598	3.527	30.339
31	69 32 30.0 3450.3	3.0	.64	5.18	.45	8.68	20.735	3.496	30.352
June 1	70 30 00.3 3449.0	- 2.8	-0.53	-5.10	-0.34	8.68	+20.873	-3.490	30.370
2	71 27 29.3 3447.8	2.7	.41	5.00	.22	8.68	21.010	3.510	30.385
3	72 24 57.1 3446.5	2.6	.29	4.90	- .10	8.67	21.148	3.553	30.394
4	73 22 23.6 3445.2	2.5	.17	4.78	+ .03	8.67	21.286	3.610	30.394
5	74 19 48.8 3444.1	2.4	- .05	4.68	.15	8.67	21.423	3.668	30.379
6	75 17 12.9 3442.9	- 2.3	+0.06	-4.59	+0.26	8.67	+21.561	-3.710	30.349
7	76 14 35.8 3441.9	2.2	.16	4.50	.36	8.67	21.699	3.718	30.307
8	77 11 57.7 3441.0	2.0	.23	4.44	.43	8.67	21.836	3.678	30.261
9	78 09 18.7 3440.1	1.8	.26	4.42	.46	8.67	21.974	3.588	30.220
10	79 06 38.8 3439.4	1.5	.26	4.42	.47	8.67	22.112	3.464	30.197
11	80 03 58.2 3438.8	- 1.2	+0.23	-4.46	+0.44	8.67	+22.249	-3.328	30.194
12	81 01 17.0 3438.2	1.0	.17	4.53	.38	8.67	22.387	3.212	30.211
13	81 58 35.2 3437.9	0.8	+ .09	4.61	.30	8.66	22.524	3.134	30.240
14	82 55 53.1 3437.4	0.6	- .02	4.73	.19	8.66	22.662	3.106	30.274
15	83 53 10.5 3437.2	0.5	.15	4.86	+ .06	8.66	22.800	3.120	30.301
16	84 50 27.7 3436.8	- 0.4	-0.27	-4.98	-0.06	8.66	+22.937	-3.163	30.315
17	85 47 44.5 3436.6	0.3	.41	5.11	.19	8.66	23.075	3.218	30.315
18	86 45 01.1 3436.3	0.2	.53	5.23	.31	8.66	23.213	3.267	30.302
19	87 42 17.4 3436.1	- 0.1	.64	5.34	.42	8.66	23.350	3.297	30.278
20	88 39 33.5 3435.8	0.0	.73	5.42	.51	8.66	23.488	3.305	30.249
21	89 36 49.3 3435.5	+ 0.2	-0.79	-5.48	-0.57	8.66	+23.626	-3.284	30.220
22	90 34 04.8 3435.2	0.4	.83	5.51	.61	8.66	23.763	3.237	30.195
23	91 31 20.0 3434.9	0.6	.84	5.51	.62	8.66	23.901	3.171	30.180
24	92 28 34.9 3434.6	0.8	.83	5.49	.61	8.66	24.038	3.095	30.174
25	93 25 49.5 3434.3	1.0	.79	5.44	.57	8.66	24.176	3.019	30.182
26	94 23 03.8 3433.9	+ 1.2	-0.73	-5.37	-0.51	8.66	+24.314	-2.953	30.200
27	95 20 17.7 3433.5	1.4	.65	5.28	.43	8.66	24.451	2.907	30.227
28	96 17 31.2 3433.1	1.6	.56	5.16	.33	8.66	24.589	2.884	30.259
29	97 14 44.3 3432.8	1.7	.44	5.03	.21	8.66	24.727	2.890	30.292
30	98 11 57.1 3432.4	1.8	.31	4.88	- .08	8.66	24.864	2.922	30.320
July 1	99 09 09.5 3432.0	+ 1.9	-0.18	-4.73	+0.05	8.66	+25.002	-2.971	30.338
2	100 06 21.5 3432.0	+ 2.0	-0.06	-4.59	+0.17	8.66	+25.140	-3.029	30.345

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
	^h ^m ^s	[°] ['] ["]		['] ["]	^m ^s
May 17	3 35 03.97 ^s	+19 16 39.0	I·011 4538	15 50.30	+ 3 42.22
18	3 39 02.30 ^{238.33}	19 30 04.5 + 805.5	·011 6664 ⁺²¹²⁶	15 50.10	3 40.45 - 1.77
19	3 43 01.20 ^{238.90}	19 43 10.1 785.6	·011 8756 ²⁰⁹²	15 49.90	3 38.10 2.35
20	3 47 00.67 ^{239.47}	19 55 55.7 765.6	·012 0809 ²⁰⁵³	15 49.71	3 35.18 2.92
21	3 51 00.70 ^{240.03}	20 08 20.9 745.2	·012 2821 ²⁰¹²	15 49.52	3 31.70 3.48
	240.58	724.6	1968		4.03
22	3 55 01.28 ^{241.12}	+20 20 25.5 + 703.8	I·012 4789 ⁺¹⁹²¹	15 49.33	+ 3 27.67 - 4.57
23	3 59 02.40 ^{241.65}	20 32 09.3 682.7	·012 6710 ¹⁸⁷³	15 49.15	3 23.10 5.10
24	4 03 04.05 ^{242.17}	20 43 32.0 661.3	·012 8583 ¹⁸²³	15 48.98	3 18.00 5.61
25	4 07 06.22 ^{242.67}	20 54 33.3 639.8	·013 0406 ¹⁷⁷³	15 48.81	3 12.39 6.11
26	4 11 08.89 ^{243.16}	21 05 13.1 618.0	·013 2179 ¹⁷²²	15 48.64	3 06.28 6.60
27	4 15 12.05 ^{243.63}	+21 15 31.1 + 595.9	I·013 3901 ⁺¹⁶⁷²	15 48.48	+ 2 59.68 - 7.07
28	4 19 15.68 ^{244.08}	21 25 27.0 573.8	·013 5573 ¹⁶²¹	15 48.32	2 52.61 7.52
29	4 23 19.76 ^{244.51}	21 35 00.8 551.3	·013 7194 ¹⁵⁷²	15 48.17	2 45.09 7.96
30	4 27 24.27 ^{244.94}	21 44 12.1 528.6	·013 8766 ¹⁵²⁴	15 48.02	2 37.13 8.37
31	4 31 29.21 ^{245.33}	21 53 00.7 505.9	·014 0290 ¹⁴⁷⁷	15 47.88	2 28.76 8.78
June 1	4 35 34.54 ^{245.72}	+22 01 26.6 + 482.7	I·014 1767 ⁺¹⁴³¹	15 47.74	+ 2 19.98 - 9.17
2	4 39 40.26 ^{246.09}	22 09 29.3 459.6	·014 3198 ¹³⁸⁸	15 47.61	2 10.81 9.53
3	4 43 46.35 ^{246.43}	22 17 08.9 436.1	·014 4586 ¹³⁴⁸	15 47.48	2 01.28 9.88
4	4 47 52.78 ^{246.76}	22 24 25.0 412.6	·014 5934 ¹³⁰⁸	15 47.35	1 51.40 10.21
5	4 51 59.54 ^{247.07}	22 31 17.6 389.0	·014 7242 ¹²⁷³	15 47.23	1 41.19 10.52
6	4 56 06.61 ^{247.38}	+22 37 46.6 + 365.1	I·014 8515 ⁺¹²⁴⁰	15 47.11	+ 1 30.67 - 10.82
7	5 00 13.99 ^{247.66}	22 43 51.7 341.1	·014 9755 ¹²¹⁰	15 47.00	1 19.85 11.10
8	5 04 21.65 ^{247.92}	22 49 32.8 317.1	·015 0965 ¹¹⁸¹	15 46.89	1 08.75 11.36
9	5 08 29.57 ^{248.18}	22 54 49.9 293.0	·015 2146 ¹¹⁵³	15 46.78	0 57.39 11.62
10	5 12 37.75 ^{248.42}	22 59 42.9 268.6	·015 3299 ¹¹²⁵	15 46.67	0 45.77 11.85
11	5 16 46.17 ^{248.63}	+23 04 11.5 + 244.4	I·015 4424 ⁺¹⁰⁹⁶	15 46.56	+ 0 33.92 - 12.07
12	5 20 54.80 ^{248.82}	23 08 15.9 219.9	·015 5520 ¹⁰⁶⁴	15 46.46	0 21.85 12.27
13	5 25 03.62 ^{249.02}	23 11 55.8 195.4	·015 6584 ¹⁰³⁰	15 46.36	+ 0 09.58 12.45
14	5 29 12.64 ^{249.17}	23 15 11.2 170.7	·015 7614 ⁹⁹¹	15 46.27	- 0 02.87 12.62
15	5 33 21.81 ^{249.31}	23 18 01.9 146.2	·015 8605 ⁹⁴⁹	15 46.17	0 15.49 12.76
16	5 37 31.12 ^{249.43}	+23 20 28.1 + 121.4	I·015 9554 ⁺⁹⁰⁵	15 46.08	- 0 28.25 - 12.87
17	5 41 40.55 ^{249.52}	23 22 29.5 96.7	·016 0459 ⁸⁵⁶	15 46.00	0 41.12 12.97
18	5 45 50.07 ^{249.59}	23 24 06.2 71.9	·016 1315 ⁸⁰⁴	15 45.92	0 54.09 13.05
19	5 49 59.66 ^{249.64}	23 25 18.1 47.2	·016 2119 ⁷⁵¹	15 45.85	1 07.14 13.08
20	5 54 09.30 ^{249.66}	23 26 05.3 + 22.3	·016 2870 ⁶⁹⁵	15 45.78	1 20.22 13.10
21	5 58 18.96 ^{249.65}	+23 26 27.6 - 2.4	I·016 3565 ⁺⁶³⁹	15 45.71	- 1 33.32 - 13.09
22	6 02 28.61 ^{249.61}	23 26 25.2 27.2	·016 4204 ⁵⁷⁹	15 45.65	1 46.41 13.06
23	6 06 38.22 ^{249.56}	23 25 58.0 52.0	·016 4783 ⁵²¹	15 45.60	1 59.47 12.99
24	6 10 47.78 ^{249.46}	23 25 06.0 76.6	·016 5304 ⁴⁶¹	15 45.55	2 12.46 12.90
25	6 14 57.24 ^{249.34}	23 23 49.4 101.4	·016 5765 ⁴⁰²	15 45.51	2 25.36 12.78
26	6 19 06.58 ^{249.19}	+23 22 08.0 - 126.0	I·016 6167 ⁺³⁴³	15 45.47	- 2 38.14 - 12.64
27	6 23 15.77 ^{249.03}	23 20 02.0 150.6	·016 6510 ²⁸⁴	15 45.44	2 50.78 12.47
28	6 27 24.80 ^{248.82}	23 17 31.4 175.1	·016 6794 ²²⁸	15 45.41	3 03.25 12.27
29	6 31 33.62 ^{248.61}	23 14 36.3 199.5	·016 7022 ¹⁷¹	15 45.39	3 15.52 12.05
30	6 35 42.23 ^{248.35}	23 11 16.8 223.9	·016 7193 ¹¹⁹	15 45.37	3 27.57 11.80
July 1	6 39 50.58 ^{248.09}	+23 07 32.9 - 248.2	I·016 7312 ⁺⁶⁷	15 45.36	- 3 39.37 - 11.53
2	6 43 58.67	+23 03 24.7	I·016 7379	15 45.36	- 3 50.90

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Date	Longitude		Red. to App. Long.	Latitude			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
	Mean Equinox of 1960.0			Ecliptic of						
				1960.0	1950.0	Date				
23° 26'										
July	1	99 09 09.5 ^{3432.0}	+ 1.9	- 0.18	- 4.73	+ 0.05	8.66	+ 25.002	- 2.971	30.338
	2	100 06 21.5 ^{3431.6}	2.0	- .06	4.59	.17	8.66	25.140	3.029	30.345
	3	101 03 33.1 ^{3431.3}	2.1	+ .05	4.46	.28	8.66	25.277	3.076	30.337
	4	102 00 44.4 ^{3431.1}	2.2	.15	4.34	.38	8.66	25.415	3.098	30.316
	5	102 57 55.5 ^{3430.7}	2.3	.22	4.24	.45	8.66	25.552	3.082	30.289
	6	103 55 06.2 ^{3430.7}	+ 2.5	+ 0.26	- 4.18	+ 0.49	8.66	+ 25.690	- 3.018	30.262
	7	104 52 16.9 ^{3430.5}	2.8	.27	4.14	.50	8.66	25.828	2.912	30.246
	8	105 49 27.4 ^{3430.6}	3.1	.25	4.13	.48	8.66	25.965	2.781	30.248
	9	106 46 38.0 ^{3430.8}	3.3	.20	4.15	.43	8.66	26.103	2.656	30.273
	10	107 43 48.8 ^{3431.1}	3.6	+ .11	4.21	.34	8.66	26.241	2.561	30.316
	11	108 40 59.9 ^{3431.4}	+ 3.7	0.00	- 4.29	+ 0.23	8.66	+ 26.378	- 2.515	30.366
	12	109 38 11.3 ^{3432.0}	3.9	- .11	4.38	+ .11	8.66	26.516	2.519	30.414
	13	110 35 23.3 ^{3432.4}	4.0	.24	4.47	- .02	8.66	26.653	2.561	30.450
	14	111 32 35.7 ^{3433.1}	4.0	.37	4.57	.15	8.66	26.791	2.623	30.472
	15	112 29 48.8 ^{3433.7}	4.1	.50	4.66	.28	8.66	26.929	2.686	30.477
	16	113 27 02.5 ^{3434.3}	+ 4.2	- 0.61	- 4.73	- 0.39	8.66	+ 27.066	- 2.737	30.471
	17	114 24 16.8 ^{3435.0}	4.3	.70	4.78	.48	8.66	27.204	2.764	30.459
	18	115 21 31.8 ^{3435.7}	4.4	.77	4.81	.55	8.66	27.342	2.765	30.443
	19	116 18 47.5 ^{3436.4}	4.6	.81	4.81	.59	8.66	27.479	2.741	30.432
	20	117 16 03.9 ^{3437.0}	4.8	.83	4.79	.61	8.66	27.617	2.696	30.427
	21	118 13 20.9 ^{3437.7}	+ 5.0	- 0.82	- 4.73	- 0.60	8.66	+ 27.755	- 2.640	30.434
	22	119 10 38.6 ^{3438.3}	5.2	.77	4.65	.56	8.66	27.892	2.581	30.451
	23	120 07 56.9 ^{3439.0}	5.3	.71	4.54	.50	8.66	28.030	2.532	30.480
	24	121 05 15.9 ^{3439.6}	5.5	.63	4.41	.42	8.66	28.167	2.501	30.518
	25	122 02 35.5 ^{3440.2}	5.7	.53	4.26	.32	8.66	28.305	2.493	30.563
	26	122 59 55.7 ^{3440.8}	+ 5.8	- 0.40	- 4.08	- 0.19	8.66	+ 28.443	- 2.515	30.607
	27	123 57 16.5 ^{3441.4}	5.9	.27	3.90	- .06	8.67	28.580	2.565	30.650
	28	124 54 37.9 ^{3441.8}	5.9	- .13	3.72	+ .07	8.67	28.718	2.635	30.683
	29	125 51 59.7 ^{3442.5}	6.0	.00	3.54	.20	8.67	28.856	2.717	30.703
	30	126 49 22.2 ^{3442.9}	6.0	+ .11	3.37	.31	8.67	28.993	2.796	30.711
Aug.	31	127 46 45.1 ^{3443.6}	+ 6.1	+ 0.21	- 3.22	+ 0.41	8.67	+ 29.131	- 2.856	30.706
	1	128 44 08.7 ^{3444.0}	6.2	.29	3.08	.49	8.67	29.269	2.884	30.692
	2	129 41 32.7 ^{3444.7}	6.4	.34	2.97	.54	8.67	29.406	2.870	30.675
	3	130 38 57.4 ^{3445.4}	6.6	.37	2.89	.56	8.67	29.544	2.815	30.665
	4	131 36 22.8 ^{3446.0}	6.8	.35	2.85	.54	8.67	29.681	2.729	30.670
	5	132 33 48.8 ^{3446.9}	+ 7.0	+ 0.30	- 2.84	+ 0.49	8.68	+ 29.819	- 2.635	30.694
	6	133 31 15.7 ^{3447.9}	7.2	.23	2.86	.41	8.68	29.957	2.559	30.737
	7	134 28 43.6 ^{3448.8}	7.4	+ .12	2.91	.30	8.68	30.094	2.522	30.792
	8	135 26 12.4 ^{3450.0}	7.5	.00	2.97	.18	8.68	30.232	2.537	30.851
	9	136 23 42.4 ^{3451.2}	7.6	- .13	3.03	+ .05	8.68	30.370	2.597	30.900
	10	137 21 13.6 ^{3452.6}	+ 7.6	- 0.26	- 3.11	- 0.09	8.68	+ 30.507	- 2.686	30.935
	11	138 18 46.2 ^{3453.9}	7.7	.40	3.18	.23	8.68	30.645	2.786	30.953
	12	139 16 20.1 ^{3455.4}	7.7	.52	3.23	.35	8.68	30.783	2.876	30.955
	13	140 13 55.5 ^{3456.9}	7.8	.61	3.26	.45	8.69	30.920	2.945	30.949
	14	141 11 32.4 ^{3458.3}	7.9	.69	3.28	.53	8.69	31.058	2.989	30.938
	15	142 09 10.7 ^{3459.9}	+ 8.0	- 0.74	- 3.26	- 0.58	8.69	+ 31.195	- 3.007	30.928
16	143 06 50.6	+ 8.1	- 0.76	- 3.22	- 0.61	8.69	+ 31.333	- 3.002	30.924	

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
July 1	^{h m s} 6 39 50.58 ^s	^{° ' "} +23 07 32.9	I·016 7312	^{' "} 15 45.36	^{m s} - 3 39.37 ^s
2	6 43 58.67 ^{248.09}	23 03 24.7 ^{- 248.2}	·016 7379 ^{+ 67}	15 45.36 ^{+ 18}	3 50.90 ^{-11.53}
3	6 48 06.46 ^{247.79}	22 58 52.4 ^{272.3}	·016 7397 ^{+ 18}	15 45.36 ^{- 26}	4 02.14 ^{11.24}
4	6 52 13.94 ^{247.48}	22 53 56.0 ^{296.4}	·016 7371 ^{- 69}	15 45.36 ¹⁰⁷	4 13.07 ^{10.93}
5	6 56 21.09 ^{247.15}	22 48 35.8 ^{320.2}	·016 7302 ¹⁰⁷	15 45.36 ^{- 144}	4 23.66 ^{10.24}
6	7 00 27.89 ^{246.80}	+22 42 51.7 ^{- 367.7}	I·016 7195 ^{- 144}	15 45.37 ^{- 177}	- 4 33.90 ^{- 9.87}
7	7 04 34.32 ^{246.43}	22 36 44.0 ^{391.2}	·016 7051 ¹⁷⁷	15 45.39 ²⁰⁸	4 43.77 ^{9.50}
8	7 08 40.38 ^{246.06}	22 30 12.8 ^{414.6}	·016 6874 ²⁰⁸	15 45.40 ²⁴⁰	4 53.27 ^{9.09}
9	7 12 46.04 ^{245.66}	22 23 18.2 ^{437.7}	·016 6666 ²⁴⁰	15 45.42 ²⁷³	5 02.36 ^{8.70}
10	7 16 51.29 ^{245.25}	22 16 00.5 ^{460.7}	·016 6426 ²⁷³	15 45.45 ^{- 307}	5 11.06 ^{8.27}
11	7 20 56.13 ^{244.84}	+22 08 19.8 ^{- 483.6}	I·016 6153 ^{- 307}	15 45.47 ^{- 342}	- 5 19.33 ^{- 7.85}
12	7 25 00.53 ^{244.40}	22 00 16.2 ^{506.2}	·016 5846 ^{- 342}	15 45.50 ^{- 382}	5 27.18 ^{7.40}
13	7 29 04.48 ^{243.95}	21 51 50.0 ^{528.8}	·016 5504 ^{- 425}	15 45.53 ^{- 470}	5 34.58 ^{6.95}
14	7 33 07.99 ^{243.51}	21 43 01.2 ^{551.0}	·016 5122 ^{- 470}	15 45.57 ^{- 518}	5 41.53 ^{6.49}
15	7 37 11.02 ^{243.03}	21 33 50.2 ^{573.1}	·016 4697 ^{- 518}	15 45.61 ^{- 569}	5 48.02 ^{6.01}
16	7 41 13.59 ^{242.57}	+21 24 17.1 ^{- 595.0}	I·016 4227 ^{- 518}	15 45.65 ^{- 569}	- 5 54.03 ^{- 5.52}
17	7 45 15.66 ^{242.07}	21 14 22.1 ^{616.6}	·016 3709 ^{- 569}	15 45.70 ^{- 622}	5 59.55 ^{5.01}
18	7 49 17.23 ^{241.57}	21 04 05.5 ^{638.1}	·016 3140 ^{- 622}	15 45.75 ^{- 676}	6 04.56 ^{4.50}
19	7 53 18.28 ^{241.05}	20 53 27.4 ^{659.2}	·016 2518 ^{- 676}	15 45.81 ^{- 731}	6 09.06 ^{3.96}
20	7 57 18.80 ^{240.52}	20 42 28.2 ^{680.1}	·016 1842 ^{- 731}	15 45.87 ^{- 789}	6 13.02 ^{3.43}
21	8 01 18.78 ^{239.98}	+20 31 08.1 ^{- 700.8}	I·016 1111 ^{- 789}	15 45.94 ^{- 845}	- 6 16.45 ^{- 2.87}
22	8 05 18.21 ^{239.43}	20 19 27.3 ^{721.2}	·016 0322 ^{- 845}	15 46.01 ^{- 904}	6 19.32 ^{2.30}
23	8 09 17.08 ^{238.87}	20 07 26.1 ^{741.4}	·015 9477 ^{- 904}	15 46.09 ^{- 961}	6 21.62 ^{1.73}
24	8 13 15.36 ^{238.28}	19 55 04.7 ^{761.2}	·015 8573 ^{- 961}	15 46.18 ^{- 1019}	6 23.35 ^{1.14}
25	8 17 13.06 ^{237.70}	19 42 23.5 ^{781.0}	·015 7612 ^{- 1019}	15 46.27 ^{- 1076}	6 24.49 ^{- 0.56}
26	8 21 10.17 ^{237.11}	+19 29 22.5 ^{- 800.2}	I·015 6593 ^{- 1076}	15 46.36 ^{- 1131}	- 6 25.05 ^{+ 0.06}
27	8 25 06.67 ^{236.50}	19 16 02.3 ^{819.4}	·015 5517 ^{- 1131}	15 46.46 ^{- 1184}	6 24.99 ^{+ 0.66}
28	8 29 02.56 ^{235.89}	19 02 22.9 ^{838.1}	·015 4386 ^{- 1184}	15 46.57 ^{- 1235}	6 24.33 ^{1.28}
29	8 32 57.83 ^{235.27}	18 48 24.8 ^{856.7}	·015 3202 ^{- 1235}	15 46.68 ^{- 1284}	6 23.05 ^{1.90}
30	8 36 52.48 ^{234.65}	18 34 08.1 ^{874.9}	·015 1967 ^{- 1284}	15 46.79 ^{- 1328}	6 21.15 ^{1.90}
31	8 40 46.51 ^{234.03}	+18 19 33.2 ^{- 892.9}	I·015 0683 ^{- 1328}	15 46.91 ^{- 1370}	- 6 18.63 ^{+ 3.15}
Aug. 1	8 44 39.91 ^{233.40}	18 04 40.3 ^{- 892.9}	·014 9355 ^{- 1370}	15 47.04 ^{- 1409}	6 15.48 ^{+ 3.78}
2	8 48 32.69 ^{232.78}	17 49 29.7 ^{910.6}	·014 7985 ^{- 1409}	15 47.16 ^{- 1441}	6 11.70 ^{4.41}
3	8 52 24.84 ^{232.15}	17 34 01.7 ^{928.0}	·014 6576 ^{- 1441}	15 47.29 ^{- 1473}	6 07.29 ^{5.02}
4	8 56 16.38 ^{231.54}	17 18 16.7 ^{945.0}	·014 5135 ^{- 1473}	15 47.43 ^{- 1501}	6 02.27 ^{5.65}
5	9 00 07.29 ^{230.91}	+17 02 14.9 ^{- 978.3}	I·014 3662 ^{- 1501}	15 47.57 ^{- 1526}	- 5 56.62 ^{+ 6.25}
6	9 03 57.60 ^{230.31}	16 45 56.6 ^{- 994.5}	·014 2161 ^{- 1526}	15 47.71 ^{- 1551}	5 50.37 ^{+ 6.85}
7	9 07 47.30 ^{229.70}	16 29 22.1 ^{1010.5}	·014 0635 ^{- 1551}	15 47.85 ^{- 1576}	5 43.52 ^{7.45}
8	9 11 36.41 ^{229.11}	16 12 31.6 ^{1026.0}	·013 9084 ^{- 1576}	15 47.99 ^{- 1602}	5 36.07 ^{8.03}
9	9 15 24.93 ^{228.52}	15 55 25.6 ^{1041.5}	·013 7508 ^{- 1602}	15 48.14 ^{- 1630}	5 28.04 ^{8.60}
10	9 19 12.88 ^{227.95}	+15 38 04.1 ^{- 1056.5}	I·013 5906 ^{- 1630}	15 48.29 ^{- 1661}	- 5 19.44 ^{+ 9.16}
11	9 23 00.27 ^{227.39}	15 20 27.6 ^{- 1071.4}	·013 4276 ^{- 1661}	15 48.44 ^{- 1692}	5 10.28 ^{+ 9.72}
12	9 26 47.11 ^{226.84}	15 02 36.2 ^{1085.8}	·013 2615 ^{- 1692}	15 48.60 ^{- 1728}	5 00.56 ^{10.25}
13	9 30 33.40 ^{226.29}	14 44 30.4 ^{1099.9}	·013 0923 ^{- 1728}	15 48.76 ^{- 1765}	4 50.31 ^{10.79}
14	9 34 19.17 ^{225.77}	14 26 10.5 ^{1113.8}	·012 9195 ^{- 1765}	15 48.92 ^{- 1804}	4 39.52 ^{11.31}
15	9 38 04.41 ^{225.24}	+14 07 36.7 ^{- 1127.4}	I·012 7430 ^{- 1804}	15 49.09 ^{- 1804}	- 4 28.21 ^{+ 11.82}
16	9 41 49.14 ^{224.73}	+13 48 49.3 ^{- 1127.4}	I·012 5626 ^{- 1804}	15 49.25 ^{- 1804}	- 4 16.39 ^{+ 11.82}

SUN, 1960
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1960.0	Red. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1960.0	1950.0	Date				
									23° 26'
Aug. 16	143° 06' 50.6 3461.5	+ 8.1	-0.76	-3.22	-0.61	8.69	+31.333	-3.002	30.924
17	144 04 32.1 3462.9	8.3	.75	3.13	.60	8.69	31.471	2.984	30.930
18	145 02 15.0 3464.5	8.4	.72	3.03	.57	8.69	31.608	2.961	30.947
19	145 59 59.5 3466.0	8.6	.65	2.90	.51	8.70	31.746	2.943	30.973
20	146 57 45.5 3467.6	8.7	.57	2.75	.43	8.70	31.884	2.943	31.011
21	147 55 33.1 3469.0	+ 8.8	-0.45	-2.56	-0.32	8.70	+32.021	-2.964	31.055
22	148 53 22.1 3470.4	8.9	.33	2.37	.20	8.70	32.159	3.014	31.101
23	149 51 12.5 3471.9	9.0	.21	2.17	-.08	8.70	32.296	3.093	31.143
24	150 49 04.4 3473.3	9.0	-.07	1.96	+ .05	8.70	32.434	3.195	31.178
25	151 46 57.7 3474.7	9.0	+ .07	1.75	.19	8.71	32.572	3.313	31.202
26	152 44 52.4 3475.9	+ 9.0	+0.20	-1.55	+0.31	8.71	+32.709	-3.429	31.210
27	153 42 48.3 3477.3	9.1	.31	1.36	.42	8.71	32.847	3.531	31.206
28	154 40 45.6 3478.6	9.1	.40	1.20	.50	8.71	32.985	3.604	31.190
29	155 38 44.2 3479.9	9.2	.46	1.06	.56	8.71	33.122	3.640	31.172
30	156 36 44.1 3481.2	9.3	.49	0.95	.59	8.72	33.260	3.636	31.156
Sept. 31	157 34 45.3 3482.5	+ 9.5	+0.49	-0.88	+0.58	8.72	+33.398	-3.601	31.152
1	158 32 47.8 3483.9	9.7	.45	0.84	.54	8.72	33.535	3.551	31.164
2	159 30 51.7 3485.4	9.9	.38	0.84	.46	8.72	33.673	3.507	31.195
3	160 28 57.1 3486.8	10.0	.28	0.86	.36	8.72	33.810	3.492	31.238
4	161 27 03.9 3488.5	10.1	.17	0.90	.24	8.73	33.948	3.522	31.289
5	162 25 12.4 3490.1	+10.2	+0.04	-0.94	+0.11	8.73	+34.086	-3.599	31.336
6	163 23 22.5 3491.9	10.2	-.09	1.00	-.03	8.73	34.223	3.711	31.369
7	164 21 34.4 3493.8	10.2	.23	1.06	.17	8.73	34.361	3.840	31.386
8	165 19 48.2 3495.8	10.2	.35	1.10	.30	8.74	34.499	3.967	31.385
9	166 18 04.0 3497.7	10.2	.46	1.13	.41	8.74	34.636	4.075	31.372
10	167 16 21.7 3499.8	+10.3	-0.54	-1.14	-0.50	8.74	+34.774	-4.158	31.351
11	168 14 41.5 3501.9	10.4	.61	1.12	.57	8.74	34.912	4.210	31.330
12	169 13 03.4 3504.0	10.5	.64	1.08	.61	8.74	35.049	4.239	31.312
13	170 11 27.4 3506.2	10.6	.63	0.99	.61	8.75	35.187	4.250	31.303
14	171 09 53.6 3508.2	10.7	.61	0.89	.59	8.75	35.324	4.254	31.306
15	172 08 21.8 3510.4	+10.8	-0.56	-0.76	-0.55	8.75	+35.462	-4.258	31.318
16	173 06 52.2 3512.5	11.0	.49	0.60	.48	8.75	35.600	4.275	31.341
17	174 05 24.7 3514.7	11.1	.38	0.42	.38	8.76	35.737	4.312	31.370
18	175 03 59.4 3516.7	11.1	.27	0.22	.27	8.76	35.875	4.375	31.403
19	176 02 36.1 3518.7	11.2	.14	-0.02	.15	8.76	36.013	4.467	31.435
20	177 01 14.8 3520.7	+11.2	-0.01	+0.20	-0.02	8.76	+36.150	-4.584	31.458
21	177 59 55.5 3522.8	11.2	+ .13	0.42	+ .11	8.77	36.288	4.717	31.472
22	178 58 38.3 3524.6	11.2	.27	0.63	.24	8.77	36.426	4.854	31.470
23	179 57 22.9 3526.5	11.2	.38	0.83	.35	8.77	36.563	4.979	31.455
24	180 56 09.4 3528.2	11.2	.48	1.00	.44	8.77	36.701	5.076	31.425
25	181 54 57.6 3530.1	+11.3	+0.55	+1.16	+0.51	8.78	+36.838	-5.135	31.391
26	182 53 47.7 3531.7	11.4	.60	1.29	.55	8.78	36.976	5.153	31.360
27	183 52 39.4 3533.5	11.5	.61	1.38	.56	8.78	37.114	5.138	31.336
28	184 51 32.9 3535.2	11.7	.59	1.44	.53	8.78	37.251	5.104	31.329
29	185 50 28.1 3536.9	11.9	.54	1.46	.47	8.79	37.389	5.073	31.339
30	186 49 25.0 3538.6	+12.0	+0.45	+1.46	+0.38	8.79	+37.527	-5.064	31.362
Oct. 1	187 48 23.6	+12.1	+0.34	+1.42	+0.26	8.79	+37.664	-5.091	31.394

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

SUN, 1960
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
Aug. 16	^{h m s} 9 41 49.14 ^s 224.23	^{° ′ ″} +13 48 49.3 -1140.6	I.012 5626 -1846	^{′ ″} 15 49.25	^{m s} - 4 16.39 ^s +12.34
17	9 45 33.37 ^s 223.72	13 29 48.7 1153.5	.012 3780 1888	15 49.43	4 04.05 12.83
18	9 49 17.09 ^s 223.24	13 10 35.2 1166.1	.012 1892 1932	15 49.61	3 51.22 13.32
19	9 53 00.33 ^s 222.75	12 51 09.1 1178.3	.011 9960 1977	15 49.79	3 37.90 13.80
20	9 56 43.08 ^s 222.29	12 31 30.8 1190.2	.011 7983 2021	15 49.97	3 24.10 14.27
21	10 00 25.37 ^s 221.82	+12 11 40.6 -1201.8	I.011 5962 -2068	15 50.16	- 3 09.83 +14.73
22	10 04 07.19 ^s 221.37	11 51 38.8 1213.1	.011 3894 2113	15 50.36	2 55.10 15.18
23	10 07 48.56 ^s 220.92	11 31 25.7 1224.0	.011 1781 2160	15 50.55	2 39.92 15.63
24	10 11 29.48 ^s 220.49	11 11 01.7 1234.6	.010 9621 2205	15 50.76	2 24.29 16.06
25	10 15 09.97 ^s 220.07	10 50 27.1 1244.9	.010 7416 2248	15 50.97	2 08.23 16.47
26	10 18 50.04 ^s 219.66	+10 29 42.2 -1254.8	I.010 5168 -2289	15 51.18	- 1 51.76 +16.89
27	10 22 29.70 ^s 219.27	10 08 47.4 1264.5	.010 2879 2328	15 51.39	1 34.87 17.28
28	10 26 08.97 ^s 218.88	9 47 42.9 1273.8	.010 0551 2362	15 51.61	1 17.59 17.67
29	10 29 47.85 ^s 218.52	9 26 29.1 1282.7	.009 8189 2395	15 51.83	0 59.92 18.04
30	10 33 26.37 ^s 218.16	9 05 06.4 1291.4	.009 5794 2422	15 52.06	0 41.88 18.40
31	10 37 04.53 ^s 217.83	+ 8 43 35.0 -1299.6	I.009 3372 -2445	15 52.29	- 0 23.48 +18.73
Sept. 1	10 40 42.36 ^s 217.51	8 21 55.4 1307.6	.009 0927 2466	15 52.52	- 0 04.75 19.05
2	10 44 19.87 ^s 217.21	8 00 07.8 1315.3	.008 8461 2482	15 52.75	+ 0 14.30 19.35
3	10 47 57.08 ^s 216.92	7 38 12.5 1322.6	.008 5979 2495	15 52.99	0 33.65 19.63
4	10 51 34.00 ^s 216.67	7 16 09.9 1329.7	.008 3484 2505	15 53.22	0 53.28 19.88
5	10 55 10.67 ^s 216.43	+ 6 54 00.2 -1336.4	I.008 0979 -2513	15 53.46	+ 1 13.16 +20.12
6	10 58 47.10 ^s 216.21	6 31 43.8 1342.8	.007 8466 2523	15 53.70	1 33.28 20.33
7	11 02 23.31 ^s 216.03	6 09 21.0 1349.1	.007 5943 2531	15 53.94	1 53.61 20.52
8	11 05 59.34 ^s 215.87	5 46 51.9 1354.8	.007 3412 2541	15 54.18	2 14.13 20.68
9	11 09 35.21 ^s 215.72	5 24 17.1 1360.4	.007 0871 2554	15 54.42	2 34.81 20.83
10	11 13 10.93 ^s 215.60	+ 5 01 36.7 -1365.6	I.006 8317 -2566	15 54.66	+ 2 55.64 +20.96
11	11 16 46.53 ^s 215.50	4 38 51.1 1370.5	.006 5751 2582	15 54.90	3 16.60 21.05
12	11 20 22.03 ^s 215.41	4 16 00.6 1375.0	.006 3169 2600	15 55.15	3 37.65 21.14
13	11 23 57.44 ^s 215.35	3 53 05.6 1379.3	.006 0569 2618	15 55.39	3 58.79 21.20
14	11 27 32.79 ^s 215.31	3 30 06.3 1383.2	.005 7951 2639	15 55.64	4 19.99 21.25
15	11 31 08.10 ^s 215.28	+ 3 07 03.1 -1386.7	I.005 5312 -2660	15 55.89	+ 4 41.24 +21.27
16	11 34 43.38 ^s 215.27	2 43 56.4 1390.0	.005 2652 2684	15 56.15	5 02.51 21.28
17	11 38 18.65 ^s 215.28	2 20 46.4 1392.8	.004 9968 2707	15 56.40	5 23.79 21.28
18	11 41 53.93 ^s 215.31	1 57 33.6 1395.4	.004 7261 2732	15 56.66	5 45.07 21.24
19	11 45 29.24 ^s 215.35	1 34 18.2 1397.6	.004 4529 2759	15 56.92	6 06.31 21.20
20	11 49 04.59 ^s 215.41	+ 1 11 00.6 -1399.4	I.004 1770 -2784	15 57.18	+ 6 27.51 +21.13
21	11 52 40.00 ^s 215.50	0 47 41.2 1400.8	.003 8986 2810	15 57.45	6 48.64 21.06
22	11 56 15.50 ^s 215.58	0 24 20.4 1402.0	.003 6176 2834	15 57.72	7 09.70 20.96
23	11 59 51.08 ^s 215.70	+ 0 00 58.4 1402.8	.003 3342 2859	15 57.99	7 30.66 20.85
24	12 03 26.78 ^s 215.84	- 0 22 24.4 1403.2	.003 0483 2880	15 58.26	7 51.51 20.71
25	12 07 02.62 ^s 215.98	- 0 45 47.6 -1403.3	I.002 7603 -2898	15 58.53	+ 8 12.22 +20.58
26	12 10 38.60 ^s 216.15	1 09 10.9 1403.0	.002 4705 2913	15 58.81	8 32.80 20.41
27	12 14 14.75 ^s 216.33	1 32 33.9 1402.3	.002 1792 2924	15 59.09	8 53.21 20.22
28	12 17 51.08 ^s 216.53	1 55 56.2 1401.3	.001 8868 2930	15 59.37	9 13.43 20.03
29	12 21 27.61 ^s 216.76	2 19 17.5 1399.9	.001 5938 2932	15 59.65	9 33.46 19.79
30	12 25 04.37 ^s 217.00	- 2 42 37.4 -1398.2	I.001 3006 -2931	15 59.93	+ 9 53.25 +19.56
Oct. 1	12 28 41.37 ^s	- 3 05 55.6	I.001 0075	16 00.21	+10 12.81

SUN, 1960

FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1960.0	Red. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1960.0	1950.0	Date				
									23° 26'
Oct.	1 187 48 23.6	+12.1	+0.34	+1.42	+0.26	8.79	+37.664	-5.091	31.394
	2 188 47 24.1	12.2	.22	1.38	+ .13	8.79	37.802	5.161	31.424
	3 189 46 26.3	12.2	+ .09	1.33	.00	8.80	37.940	5.269	31.447
	4 190 45 30.5	12.2	- .04	1.28	- .14	8.80	38.077	5.398	31.452
	5 191 44 36.6	12.2	.17	1.23	.27	8.80	38.215	5.532	31.441
	6 192 43 44.9	+12.2	-0.28	+1.19	-0.39	8.80	+38.352	-5.650	31.416
	7 193 42 55.2	12.3	.37	1.18	.49	8.81	38.490	5.742	31.379
	8 194 42 07.7	12.3	.44	1.19	.56	8.81	38.628	5.803	31.341
	9 195 41 22.4	12.4	.47	1.23	.60	8.81	38.765	5.836	31.304
	10 196 40 39.4	12.6	.48	1.29	.62	8.81	38.903	5.846	31.275
	11 197 39 58.7	+12.7	-0.46	+1.39	-0.60	8.82	+39.041	-5.843	31.257
	12 198 39 20.2	12.8	.41	1.51	.56	8.82	39.178	5.838	31.248
	13 199 38 44.1	13.0	.34	1.66	.50	8.82	39.316	5.841	31.251
	14 200 38 10.3	13.1	.26	1.81	.42	8.82	39.453	5.861	31.262
	15 201 37 38.8	13.2	.15	1.99	.32	8.83	39.591	5.905	31.277
	16 202 37 09.6	+13.2	-0.02	+2.19	-0.20	8.83	+39.729	-5.974	31.293
	17 203 36 42.6	13.3	+ .11	2.40	- .07	8.83	39.866	6.069	31.305
	18 204 36 17.8	13.3	.25	2.61	+ .06	8.83	40.004	6.183	31.307
	19 205 35 55.2	13.3	.38	2.81	.19	8.84	40.142	6.304	31.294
	20 206 35 34.8	13.3	.50	3.00	.30	8.84	40.279	6.418	31.266
	21 207 35 16.3	+13.3	+0.61	+3.17	+0.40	8.84	+40.417	-6.506	31.227
	22 208 34 59.9	13.4	.68	3.32	.47	8.84	40.555	6.556	31.176
	23 209 34 45.3	13.6	.74	3.44	.52	8.85	40.692	6.559	31.126
	24 210 34 32.6	13.7	.75	3.53	.53	8.85	40.830	6.525	31.086
	25 211 34 21.6	13.9	.74	3.58	.51	8.85	40.967	6.466	31.059
	26 212 34 12.3	+14.1	+0.69	+3.59	+0.45	8.85	+41.105	-6.404	31.051
	27 213 34 04.6	14.3	.61	3.58	.37	8.86	41.243	6.363	31.059
	28 214 33 58.6	14.4	.51	3.54	.26	8.86	41.380	6.355	31.076
	29 215 33 54.2	14.5	.39	3.48	+ .13	8.86	41.518	6.389	31.094
	30 216 33 51.4	14.6	.26	3.41	.00	8.86	41.656	6.460	31.106
Nov.	31 217 33 50.3	+14.6	+0.13	+3.34	-0.14	8.87	+41.793	-6.555	31.105
	1 218 33 50.9	14.6	.00	3.27	.27	8.87	41.931	6.658	31.087
	2 219 33 53.2	14.7	- .11	3.22	.39	8.87	42.069	6.752	31.055
	3 220 33 57.2	14.7	.21	3.18	.49	8.87	42.206	6.822	31.011
	4 221 34 03.1	14.8	.27	3.17	.56	8.87	42.344	6.860	30.962
	5 222 34 10.8	+15.0	-0.31	+3.19	-0.61	8.88	+42.481	-6.867	30.913
	6 223 34 20.5	15.1	.34	3.22	.64	8.88	42.619	6.847	30.872
	7 224 34 32.1	15.3	.32	3.29	.63	8.88	42.757	6.811	30.841
	8 225 34 45.6	15.5	.29	3.37	.60	8.88	42.894	6.767	30.821
	9 226 35 01.1	15.6	.22	3.49	.54	8.89	43.032	6.727	30.812
	10 227 35 18.6	+15.8	-0.14	+3.63	-0.46	8.89	+43.170	-6.703	30.814
	11 228 35 38.0	15.9	- .03	3.78	.36	8.89	43.307	6.699	30.822
	12 229 35 59.4	16.0	+ .08	3.94	.25	8.89	43.445	6.719	30.833
	13 230 36 22.8	16.1	.21	4.12	- .13	8.89	43.583	6.766	30.839
	14 231 36 48.0	16.2	.34	4.30	.00	8.90	43.720	6.834	30.841
	15 232 37 15.2	+16.2	+0.47	+4.47	+0.12	8.90	+43.858	-6.912	30.830
	16 233 37 44.2	+16.3	+0.58	+4.62	+0.23	8.90	+43.995	-6.990	30.806

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
Oct. 1	^h 12 ^m 28 ^s 41.37 ^s	- 3 05 55.6	1.001 0075	16 00.21	+10 12.81 ^s
2	12 32 18.63 ^{217.26}	3 29 11.8 ^{-1396.2}	.000 7150 ⁻²⁹²⁵	16 00.49	10 32.09 ^{+19.28}
3	12 35 56.19 ^{217.56}	3 52 25.5 ^{1393.7}	.000 4233 ²⁹¹⁷	16 00.77	10 51.09 ^{19.00}
4	12 39 34.06 ^{217.87}	4 15 36.5 ^{1391.0}	1.000 1327 ²⁹⁰⁶	16 01.05	11 09.77 ^{18.68}
5	12 43 12.27 ^{218.21}	4 38 44.4 ^{1387.9}	0.999 8434 ²⁸⁹³	16 01.33	11 28.10 ^{18.33}
6	12 46 50.84 ^{218.57}	5 01 48.9 ^{1384.5}	0.999 5555 ²⁸⁷⁹	16 01.61	+11 46.08 ^{17.98}
7	12 50 29.81 ^{218.97}	5 24 49.6 ^{-1380.7}	.999 2691 ⁻²⁸⁶⁴	16 01.88	12 03.66 ^{+17.58}
8	12 54 09.19 ^{219.38}	5 47 46.3 ^{1376.7}	.998 9840 ²⁸⁵¹	16 02.16	12 20.83 ^{17.17}
9	12 57 49.01 ^{219.82}	6 10 38.5 ^{1372.2}	.998 7002 ²⁸³⁸	16 02.43	12 37.56 ^{16.73}
10	13 01 29.29 ^{220.28}	6 33 25.9 ^{1367.4}	.998 4176 ²⁸²⁶	16 02.70	12 53.84 ^{16.28}
11	13 05 10.05 ^{220.76}	6 56 08.2 ^{1362.3}	0.998 1358 ²⁸¹⁸	16 02.98	+13 09.64 ^{15.80}
12	13 08 51.30 ^{221.25}	7 18 44.9 ^{-1356.7}	.997 8550 ⁻²⁸⁰⁸	16 03.25	13 24.94 ^{+15.30}
13	13 12 33.07 ^{221.77}	7 41 15.7 ^{1350.8}	.997 5748 ²⁸⁰²	16 03.52	13 39.72 ^{14.78}
14	13 16 15.38 ^{222.31}	8 03 40.3 ^{1344.6}	.997 2952 ²⁷⁹⁶	16 03.79	13 53.97 ^{14.25}
15	13 19 58.23 ^{222.85}	8 25 58.2 ^{1337.9}	.997 0161 ²⁷⁹¹	16 04.06	14 07.67 ^{13.70}
16	13 23 41.66 ^{223.43}	8 48 09.0 ^{1330.8}	0.996 7372 ²⁷⁸⁹	16 04.33	+14 20.79 ^{13.12}
17	13 27 25.67 ^{224.01}	9 10 12.4 ^{-1323.4}	.996 4585 ⁻²⁷⁸⁷	16 04.60	14 33.33 ^{+12.54}
18	13 31 10.29 ^{224.62}	9 32 08.0 ^{1315.6}	.996 1798 ²⁷⁸⁷	16 04.87	14 45.26 ^{11.93}
19	13 34 55.52 ^{225.23}	9 53 55.3 ^{1307.3}	.995 9010 ²⁷⁸⁸	16 05.14	14 56.58 ^{11.32}
20	13 38 41.38 ^{225.86}	10 15 34.0 ^{1298.7}	.995 6220 ²⁷⁹⁰	16 05.41	15 07.27 ^{10.69}
21	13 42 27.89 ^{226.51}	-10 37 03.7 ^{1289.7}	0.995 3429 ²⁷⁹¹	16 05.68	+15 17.31 ^{10.04}
22	13 46 15.05 ^{227.16}	10 58 24.0 ^{-1280.3}	.995 0636 ⁻²⁷⁹³	16 05.95	15 26.70 ^{+ 9.39}
23	13 50 02.88 ^{227.83}	11 19 34.5 ^{1270.5}	.994 7843 ²⁷⁹³	16 06.22	15 35.42 ^{8.72}
24	13 53 51.39 ^{228.51}	11 40 34.7 ^{1260.2}	.994 5053 ²⁷⁹⁰	16 06.49	15 43.47 ^{8.05}
25	13 57 40.59 ^{229.20}	12 01 24.2 ^{1249.5}	.994 2267 ²⁷⁸⁶	16 06.76	15 50.84 ^{7.37}
26	14 01 30.48 ^{229.89}	-12 22 02.6 ^{1238.4}	0.993 9491 ²⁷⁷⁶	16 07.03	+15 57.50 ^{6.66}
27	14 05 21.08 ^{230.60}	12 42 29.6 ^{-1227.0}	.993 6728 ⁻²⁷⁶³	16 07.30	16 03.46 ^{+ 5.96}
28	14 09 12.40 ^{231.32}	13 02 44.6 ^{1215.0}	.993 3982 ²⁷⁴⁶	16 07.57	16 08.70 ^{5.24}
29	14 13 04.45 ^{232.05}	13 22 47.3 ^{1202.7}	.993 1257 ²⁷²⁵	16 07.83	16 13.20 ^{4.50}
30	14 16 57.24 ^{232.79}	13 42 37.3 ^{1190.0}	.992 8557 ²⁷⁰⁰	16 08.10	16 16.96 ^{3.76}
31	14 20 50.79 ^{233.55}	-14 02 14.1 ^{1176.8}	0.992 5886 ²⁶⁷¹	16 08.36	+16 19.96 ^{3.00}
Nov. 1	14 24 45.12 ^{234.33}	14 21 37.4 ^{-1163.3}	.992 3246 ⁻²⁶⁴⁰	16 08.61	16 22.18 ^{+ 2.22}
2	14 28 40.23 ^{235.11}	14 40 46.9 ^{1149.5}	.992 0642 ²⁶⁰⁴	16 08.87	16 23.62 ^{1.44}
3	14 32 36.14 ^{235.91}	14 59 42.0 ^{1135.1}	.991 8074 ²⁵⁶⁸	16 09.12	16 24.25 ^{+ 0.63}
4	14 36 32.87 ^{236.73}	15 18 22.5 ^{1120.5}	.991 5543 ²⁵³¹	16 09.37	16 24.08 ^{- 0.17}
5	14 40 30.42 ^{237.55}	-15 36 47.9 ^{1105.4}	0.991 3051 ²⁴⁹²	16 09.61	+16 23.08 ^{1.00}
6	14 44 28.81 ^{238.39}	15 54 57.8 ^{-1089.9}	.991 0596 ⁻²⁴⁵⁵	16 09.85	16 21.25 ^{- 1.83}
7	14 48 28.04 ^{239.23}	16 12 51.9 ^{1074.1}	.990 8179 ²⁴¹⁷	16 10.09	16 18.58 ^{2.67}
8	14 52 28.12 ^{240.08}	16 30 29.8 ^{1057.9}	.990 5798 ²³⁸¹	16 10.32	16 15.05 ^{3.53}
9	14 56 29.06 ^{240.94}	16 47 51.0 ^{1041.2}	.990 3452 ²³⁴⁶	16 10.55	16 10.67 ^{4.38}
10	15 00 30.86 ^{241.80}	-17 04 55.2 ^{1024.2}	0.990 1141 ²³¹¹	16 10.78	+16 05.43 ^{5.24}
11	15 04 33.53 ^{242.67}	17 21 42.0 ^{-1006.8}	.989 8863 ⁻²²⁷⁸	16 11.00	15 59.32 ^{- 6.11}
12	15 08 37.06 ^{243.53}	17 38 10.9 ^{988.9}	.989 6615 ²²⁴⁸	16 11.22	15 52.35 ^{6.97}
13	15 12 41.45 ^{244.39}	17 54 21.6 ^{970.7}	.989 4398 ²²¹⁷	16 11.44	15 44.50 ^{7.85}
14	15 16 46.71 ^{245.26}	18 10 13.6 ^{952.0}	.989 2209 ²¹⁸⁹	16 11.65	15 35.79 ^{8.71}
15	15 20 52.84 ^{246.13}	-18 25 46.7 ^{933.1}	0.989 0046 ²¹⁶³	16 11.87	+15 26.22 ^{9.57}
16	15 24 59.82 ^{246.98}	-18 41 00.3 ^{- 913.6}	0.988 7908 ⁻²¹³⁸	16 12.08	+15 15.78 ^{-10.44}

SUN, 1960
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1960.0	Red. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1960.0	1950.0	Date				
									23° 26'
Nov. 16	233 37 44.2	+16.3	+0.58	+4.62	+0.23	8.90	+43.995	-6.990	30.806
17	234 38 15.0 ^{3630.8}	16.4	.69	4.77	.33	8.90	44.133	7.049	30.767
18	235 38 47.5 ^{3632.5}	16.5	.76	4.89	.40	8.90	44.271	7.073	30.718
19	236 39 21.6 ^{3634.1}	16.6	.82	4.98	.45	8.91	44.408	7.050	30.664
20	237 39 57.2 ^{3635.6} ^{3637.0}	16.8	.83	5.03	.46	8.91	44.546	6.981	30.616
21	238 40 34.2	+17.1	+0.82	+5.05	+0.44	8.91	+44.684	-6.877	30.582
22	239 41 12.6 ^{3638.4}	17.3	.77	5.04	.39	8.91	44.821	6.763	30.569
23	240 41 52.2 ^{3639.6}	17.6	.68	5.00	.31	8.91	44.959	6.661	30.574
24	241 42 32.9 ^{3640.7}	17.8	.59	4.93	.20	8.91	45.096	6.596	30.591
25	242 43 14.7 ^{3641.8} ^{3642.9}	17.9	.47	4.84	+ .08	8.92	45.234	6.574	30.615
26	243 43 57.6	+18.0	+0.35	+4.75	-0.05	8.92	+45.372	-6.596	30.633
27	244 44 41.4 ^{3643.8}	18.1	.21	4.64	.19	8.92	45.509	6.645	30.638
28	245 45 26.3 ^{3644.9}	18.2	+ .09	4.54	.32	8.92	45.647	6.706	30.630
29	246 46 12.2 ^{3645.9}	18.3	- .03	4.45	.44	8.92	45.785	6.763	30.606
30	247 46 59.1 ^{3646.9} ^{3647.9}	18.4	.13	4.38	.54	8.92	45.922	6.800	30.569
Dec. 1	248 47 47.0	+18.5	-0.20	+4.33	-0.62	8.93	+46.060	-6.809	30.528
2	249 48 36.0 ^{3649.0}	18.6	.26	4.29	.68	8.93	46.198	6.786	30.486
3	250 49 26.1 ^{3650.1}	18.8	.28	4.29	.70	8.93	46.335	6.735	30.449
4	251 50 17.3 ^{3651.2}	19.0	.28	4.32	.70	8.93	46.473	6.664	30.421
5	252 51 09.6 ^{3652.3} ^{3653.5}	19.2	.24	4.37	.67	8.93	46.610	6.582	30.406
6	253 52 03.1	+19.5	-0.18	+4.45	-0.61	8.93	+46.748	-6.503	30.402
7	254 52 57.7 ^{3654.6}	19.7	.10	4.54	.53	8.93	46.886	6.435	30.410
8	255 53 53.5 ^{3655.8}	19.9	- .01	4.65	.44	8.93	47.023	6.388	30.426
9	256 54 50.4 ^{3656.9}	20.0	+ .11	4.77	.33	8.94	47.161	6.365	30.447
10	257 55 48.5 ^{3658.1} ^{3659.3}	20.1	.23	4.91	.21	8.94	47.299	6.369	30.467
11	258 56 47.8	+20.2	+0.35	+5.04	-0.09	8.94	+47.436	-6.397	30.483
12	259 57 48.1 ^{3660.3}	20.3	.47	5.17	+ .03	8.94	47.574	6.440	30.488
13	260 58 49.6 ^{3661.5}	20.4	.59	5.28	.14	8.94	47.712	6.488	30.483
14	261 59 52.1 ^{3662.5}	20.5	.69	5.39	.24	8.94	47.849	6.527	30.463
15	263 00 55.6 ^{3663.5} ^{3664.5}	20.6	.76	5.46	.31	8.94	47.987	6.539	30.432
16	264 02 00.1	+20.8	+0.81	+5.52	+0.36	8.94	+48.124	-6.511	30.394
17	265 03 05.4 ^{3665.3}	21.0	.83	5.54	.38	8.94	48.262	6.434	30.357
18	266 04 11.4 ^{3666.0}	21.3	.81	5.52	.36	8.94	48.400	6.314	30.330
19	267 05 18.1 ^{3666.7}	21.6	.77	5.48	.32	8.94	48.537	6.169	30.322
20	268 06 25.3 ^{3667.2} ^{3667.6}	21.8	.69	5.39	.24	8.95	48.675	6.028	30.337
21	269 07 32.9	+22.1	+0.60	+5.29	+0.14	8.95	+48.813	-5.916	30.369
22	270 08 40.9 ^{3668.0}	22.3	.48	5.16	+ .02	8.95	48.950	5.852	30.410
23	271 09 49.0 ^{3668.1}	22.4	.34	5.01	- .12	8.95	49.088	5.836	30.448
24	272 10 57.2 ^{3668.2}	22.6	.20	4.86	.26	8.95	49.226	5.860	30.478
25	273 12 05.5 ^{3668.3}	22.6	+ .07	4.72	.39	8.95	49.363	5.904	30.490
26	274 13 13.8	+22.7	-0.05	+4.59	-0.51	8.95	+49.501	-5.947	30.489
27	275 14 22.2 ^{3668.4}	22.8	.16	4.46	.62	8.95	49.638	5.976	30.473
28	276 15 30.5 ^{3668.3}	23.0	.24	4.36	.70	8.95	49.776	5.981	30.451
29	277 16 38.9 ^{3668.4}	23.1	.29	4.30	.75	8.95	49.914	5.956	30.426
30	278 17 47.2 ^{3668.3}	23.3	.32	4.25	.78	8.95	50.051	5.904	30.406
31	279 18 55.5	+23.5	-0.31	+4.24	-0.77	8.95	+50.189	-5.830	30.394
32	280 20 03.9 ^{3668.4}	+23.8	-0.29	+4.25	-0.74	8.95	+50.327	-5.745	30.393

To obtain the longitude referred to the mean equinox of 1950.0, subtract 8' 22".7.

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Equation of Time Apparent - Mean
Nov. 16	^h ^m ^s 15 24 59.82 ^s	[°] ['] [″] -18 41 00.3	0.988 7908	16 12.08	^m ^s +15 15.78 ^s
17	15 29 07.67 ^{247.85}	18 55 54.0 ^{- 893.7}	.988 5793 ⁻²¹¹⁵	16 12.28	15 04.49 ^{-11.29}
18	15 33 16.36 ^{248.69}	19 10 27.7 ^{873.7}	.988 3698 ²⁰⁹⁵	16 12.49	14 52.35 ^{12.14}
19	15 37 25.89 ^{249.53}	19 24 40.7 ^{853.0}	.988 1624 ²⁰⁷⁴	16 12.69	14 39.38 ^{12.97}
20	15 41 36.24 ^{250.35} ^{251.17}	19 38 32.7 ^{832.0} ^{810.7}	.987 9570 ²⁰⁵⁴ ²⁰³³	16 12.90	14 25.59 ^{13.79} ^{14.61}
21	15 45 47.41 ^{251.97}	-19 52 03.4 ^{- 789.0}	0.987 7537 ⁻²⁰⁰⁹	16 13.10	+14 10.98 ^{-15.40}
22	15 49 59.38 ^{252.74}	20 05 12.4 ^{766.9}	.987 5528 ¹⁹⁸⁴	16 13.29	13 55.58 ^{16.18}
23	15 54 12.12 ^{253.50}	20 17 59.3 ^{744.4}	.987 3544 ¹⁹⁵⁵	16 13.49	13 39.40 ^{16.95}
24	15 58 25.62 ^{254.26} ^{254.98}	20 30 23.7 ^{721.6} ^{698.3}	.987 1589 ¹⁹²¹ ¹⁸⁸⁵	16 13.68	13 22.45 ^{17.70} ^{18.43}
25	16 02 39.88 ^{255.71}	20 42 25.3 ^{- 674.9}	.986 9668 ⁻¹⁸⁴³	16 13.87	13 04.75 ^{-19.15}
26	16 06 54.86 ^{256.41}	-20 54 03.6 ^{651.0}	0.986 7783 ¹⁷⁹⁹	16 14.06	+12 46.32 ^{-19.86}
27	16 11 10.57 ^{257.09}	21 05 18.5 ^{626.8}	.986 5940 ¹⁷⁵¹	16 14.24	12 27.17 ^{-20.54}
28	16 15 26.98 ^{257.78} ^{258.44}	21 16 09.5 ^{602.4} ^{577.7}	.986 4141 ¹⁷⁰⁰ ¹⁶⁴⁷	16 14.42	12 07.31 ^{-21.23} ^{21.88}
29	16 19 44.07 ^{259.08}	21 26 36.3 ^{- 552.6}	.986 2390 ⁻¹⁵⁹³	16 14.59	11 46.77 ^{-22.52}
30	16 24 01.85 ^{259.70}	21 36 38.7 ^{527.4}	.986 0690 ¹⁵³⁷	16 14.76	11 25.54 ^{-23.15}
Dec. 1	16 28 20.29 ^{260.32}	-21 46 16.4 ^{501.8}	0.985 9043 ¹⁴⁸⁰	16 14.92	+11 03.66 ^{-23.75}
2	16 32 39.37 ^{260.90}	21 55 29.0 ^{476.0}	.985 7450 ¹⁴²⁵	16 15.08	10 41.14 ^{-24.34}
3	16 36 59.07 ^{261.46}	22 04 16.4 ^{450.0}	.985 5913 ¹³⁶⁷	16 15.23	10 17.99 ^{-24.90}
4	16 41 19.39 ^{262.00}	22 12 38.2 ^{- 423.8}	.985 4433 ⁻¹³¹³	16 15.38	9 54.24 ^{-25.45}
5	16 45 40.29 ^{262.52}	22 20 34.2 ^{397.2}	.985 3008 ¹²⁵⁸	16 15.52	9 29.90 ^{-25.96}
6	16 50 01.75 ^{263.01}	-22 28 04.2 ^{370.5}	0.985 1641 ¹²⁰⁵	16 15.65	+ 9 05.00 ^{-26.45}
7	16 54 23.75 ^{263.47}	22 35 08.0 ^{343.7}	.985 0328 ¹¹⁵³	16 15.78	8 39.55 ^{-26.92}
8	16 58 46.27 ^{263.91}	22 41 45.2 ^{316.5}	.984 9070 ¹¹⁰²	16 15.91	8 13.59 ^{-27.36}
9	17 03 09.28 ^{264.32}	22 47 55.7 ^{- 289.3}	.984 7865 ⁻¹⁰⁵⁵	16 16.03	7 47.14 ^{-27.76}
10	17 07 32.75 ^{264.70}	22 53 39.4 ^{261.9}	.984 6712 ¹⁰⁰⁸	16 16.14	7 20.22 ^{-28.15}
11	17 11 56.66 ^{265.05}	-22 58 55.9 ^{234.3}	0.984 5610 ⁹⁶⁵	16 16.25	+ 6 52.86 ^{-28.50}
12	17 16 20.98 ^{265.37}	23 03 45.2 ^{206.5}	.984 4555 ⁹²⁴	16 16.36	6 25.10 ^{-28.81}
13	17 20 45.68 ^{265.65}	23 08 07.1 ^{178.8}	.984 3547 ⁸⁸⁵	16 16.46	5 56.95 ^{-29.09}
14	17 25 10.73 ^{265.90}	23 12 01.4 ^{- 150.8}	.984 2582 ^{- 849}	16 16.55	5 28.45 ^{-29.34}
15	17 29 36.10 ^{266.11}	23 15 27.9 ^{122.8}	.984 1658 ⁸¹⁵	16 16.64	4 59.64 ^{-29.55}
16	17 34 01.75 ^{266.27}	-23 18 26.7 ^{94.7}	0.984 0773 ⁷⁸²	16 16.73	+ 4 30.55 ^{-29.71}
17	17 38 27.65 ^{266.41}	23 20 57.5 ^{66.6}	.983 9924 ⁷⁴⁷	16 16.82	4 01.21 ^{-29.93}
18	17 42 53.76 ^{266.49}	23 23 00.3 ^{38.4}	.983 9109 ⁷¹²	16 16.88	3 31.66 ^{-29.98}
19	17 47 20.03 ^{266.54}	23 24 35.0 ^{- 10.1}	.983 8327 ^{- 675}	16 16.90	3 01.95 ^{-29.98}
20	17 51 46.44 ^{266.51}	23 25 41.6 ^{+ 18.2}	.983 7580 ⁶³⁵	16 17.05	2 32.11 ^{-29.96}
21	17 56 12.93 ^{266.45}	-23 26 20.0 ^{74.7}	0.983 6868 ⁵⁴⁵	16 17.12	+ 2 02.18 ^{-29.90}
22	18 00 39.47 ^{266.35}	23 26 30.1 ^{103.0}	.983 6193 ⁴⁹⁴	16 17.19	1 32.20 ^{-29.80}
23	18 05 06.01 ^{266.23}	23 26 11.9 ^{+ 131.2}	.983 5558 ^{- 440}	16 17.25	1 02.22 ^{-29.67}
24	18 09 32.52 ^{266.06}	23 25 25.5 ^{159.3}	.983 4967 ³⁸⁴	16 17.31	0 32.26 ^{-29.51}
25	18 13 58.97 ^{265.87}	23 24 10.8 ^{187.3}	.983 4422 ³²⁵	16 17.36	+ 0 02.36 ^{-29.31}
26	18 18 25.32 ^{265.65}	-23 22 27.8 ^{215.4}	0.983 3928 ²⁶⁵	16 17.41	- 0 27.44 ^{-29.09}
27	18 22 51.55 ^{265.40}	23 20 16.6 ^{+ 243.1}	.983 3488 ²⁰³	16 17.46	0 57.11 ^{-28.84}
28	18 27 17.61 ^{265.11}	23 17 37.3 ^{- 270.9}	.983 3104 ^{- 139}	16 17.49	1 26.62 ^{-28.56}
29	18 31 43.48 ^{265.11}	23 14 30.0 ^{- 270.9}	.983 2779 ^{- 139}	16 17.53	1 55.93 ^{-28.56}
30	18 36 09.13 ^{265.11}	23 10 54.6 ^{- 270.9}	.983 2514 ^{- 139}	16 17.55	2 25.02 ^{-28.56}
31	18 40 34.53 ^{265.11}	-23 06 51.5 ^{+ 270.9}	0.983 2311 ^{- 139}	16 17.57	- 2 53.86 ^{-28.56}
32	18 44 59.64 ^{265.11}	-23 02 20.6 ^{+ 270.9}	0.983 2172 ^{- 139}	16 17.59	- 3 22.42 ^{-28.56}

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1960-0

Date	X			Y			Z		
Jan. 0	+0.146 3641	+17 2776	-465	-0.892 0805	+2 5476	+2793	-0.386 8569	+1 1044	+1210
1	.163 6417	17 2257	519	.889 5329	2 8257	2781	.385 7525	1 2250	1206
2	.180 8674	17 1677	580	.886 7072	3 1028	2771	.384 5275	1 3449	1199
3	.198 0351	17 1047	630	.883 6044	3 3784	2756	.383 1826	1 4643	1194
4	.215 1308	17 0360	687	.880 2260	3 6527	2743	.381 7183	1 5834	1191
5	+0.232 1758	+16 9620	-740	-0.876 5733	-3 9253	-2726	-0.380 1349	+1 7016	+1182
6	.249 1378	16 8831	789	.872 6480	4 1966	2713	.378 4333	1 8192	1176
7	.266 0209	16 7989	842	.868 4514	4 4661	2695	.376 6141	1 9363	1171
8	.282 8198	16 7098	891	.863 9853	4 7342	2681	.374 6778	2 0526	1163
9	.290 5296	16 6156	942	.859 2511	5 0004	2662	.372 6252	2 1681	1155
10	+0.316 1452	+16 5167	-989	-0.854 2507	-5 2650	-2646	-0.370 4571	-2 2830	-1149
11	.332 6610	16 4129	1038	.848 9857	5 5279	2629	.368 1741	2 3972	1142
12	.349 0748	16 3041	1088	.843 4578	5 7889	2610	.365 7769	2 5105	1133
13	.365 3789	16 1907	1134	.837 6689	6 0480	2591	.363 2664	2 6230	1125
14	.381 5696	16 0727	1180	.831 6209	6 3056	2576	.360 6434	2 7348	1118
15	+0.397 6423	+15 9499	-1228	-0.825 3153	-6 5609	-2553	-0.357 9086	-2 8456	-1108
16	.413 5922	15 8223	1276	.818 7544	6 8145	2536	.355 0630	2 9558	1102
17	.429 4145	15 6903	1320	.811 9399	7 0662	2517	.352 1072	3 0649	1091
18	.445 1048	15 5534	1369	.804 8737	7 3158	2496	.349 0423	3 1733	1084
19	.460 6582	15 4119	1415	.797 5579	7 5637	2479	.345 8690	3 2807	1074
20	+0.476 0701	+15 2657	-1462	-0.789 9942	-7 8092	-2455	-0.342 5883	-3 3872	-1065
21	.491 3358	15 1147	1510	.782 1850	8 0528	2436	.339 2011	3 4927	1055
22	.506 4505	14 9588	1559	.774 1322	8 2941	2413	.335 7084	3 5974	1047
23	.521 4093	14 7981	1607	.765 8381	8 5332	2391	.332 1110	3 7008	1034
24	.536 2074	14 6325	1656	.757 3049	8 7696	2364	.328 4102	3 8031	1023
25	+0.550 8399	+14 4620	-1705	-0.748 5353	-9 0036	-2340	-0.324 6071	-3 9045	-1014
26	.565 3019	14 2866	1754	.739 5317	9 2345	2309	.320 7026	4 0044	999
27	.579 5885	14 1063	1803	.730 2972	9 4626	2281	.316 6982	4 1032	988
28	.593 6948	13 9215	1848	.720 8346	9 6874	2248	.312 5950	4 2005	973
29	.607 6163	13 7319	1896	.711 1472	9 9087	2213	.308 3945	4 2965	960
30	+0.621 3482	+13 5380	-1939	-0.701 2385	-10 1267	-2180	-0.304 0980	-4 3908	-943
31	.634 8862	13 3398	1982	.691 1118	10 3409	2142	.299 7072	4 4838	930
Feb. 1	.648 2260	13 1377	2021	.680 7709	10 5516	2107	.295 2234	4 5751	913
2	.661 3637	12 9315	2062	.670 2193	10 7584	2068	.290 6483	4 6648	897
3	.674 2052	12 7217	2098	.659 4609	10 9617	2033	.285 9835	4 7531	883
4	+0.687 0160	+12 5083	-2134	-0.648 4992	-11 1611	-1994	-0.281 2304	-4 8397	-866
5	.699 5252	12 2913	2170	.637 3381	11 3568	1957	.276 3907	4 9246	849
6	.711 8165	12 0708	2205	.625 9813	11 5488	1920	.271 4661	5 0080	834
7	.723 8873	11 8471	2237	.614 4325	11 7369	1881	.266 4581	5 0898	818
8	.735 7344	11 6201	2270	.602 6956	11 9216	1847	.261 3683	5 1699	801
9	+0.747 3545	+11 3899	-2302	-0.590 7740	-12 1021	-1805	-0.256 1984	-5 2485	-786
10	.758 7444	11 1566	2333	.578 6719	12 2791	1770	.250 9499	5 3253	768
11	.769 9010	10 9204	2362	.566 3928	12 4522	1731	.245 6246	5 4004	751
12	.780 8214	10 6812	2392	.553 9406	12 6215	1693	.240 2242	5 4740	736
13	.791 5026	10 4391	2421	.541 3191	12 7872	1657	.234 7502	5 5460	720
14	+0.801 9417	+10 1941	-2450	-0.528 5319	-12 9492	-1620	-0.229 2042	-5 6163	-703
15	.812 1358		2479	.515 5827		1580	.223 5879		684

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1960.0

Date		X		Y		Z	
Feb.	15	+0.812 1358	-2479	-0.515 5827	+1580	-0.223 5879	+684
	16	.822 0820 + 9 9462	2505	.502 4755 +13 1072	1546	.217 9032 +5 6847	671
	17	.831 7777 9 6957	2537	.489 2137 13 2618	1506	.212 1514 5 7518	651
	18	.841 2197 9 4420	2566	.475 8013 13 4124	1467	.206 3345 5 8169	638
	19	.850 4051 9 1854	2592	.462 2422 13 5591	1428	.200 4538 5 8807	616
		8 9262		13 7019		5 9423	
	20	+0.859 3313 + 8 6638	-2624	-0.448 5403 +13 8408	+1389	-0.194 5115 +6 0024	+601
	21	.867 9951 8 6638	2651	.434 6995 13 8408	1346	.188 5091 6 0024	583
	22	.876 3938 8 3987	2680	.420 7241 13 9754	1304	.182 4484 6 0607	562
	23	.884 5245 8 1307	2705	.406 6183 14 1058	1258	.176 3315 6 1169	544
	24	.892 3847 7 8602	2734	.392 3867 14 2316	1214	.170 1602 6 1713	525
		7 5868		14 3530		6 2238	
	25	+0.899 9715 + 7 3110	-2758	-0.378 0337 +14 4695	+1165	-0.163 9364 +6 2743	+505
	26	.907 2825 7 0328	2782	.363 5642 14 5814	1119	.157 6621 6 3227	484
	27	.914 3153 6 7527	2801	.348 9828 14 6882	1068	.151 3394 6 3690	463
	28	.921 0680 6 4705	2822	.334 2946 14 7902	1020	.144 9704 6 4132	442
	29	.927 5385 6 1867	2838	.319 5044 14 8872	970	.138 5572 6 4553	421
Mar.	1	+0.933 7252 + 5 9012	-2855	-0.304 6172 +14 9793	+921	-0.132 1019 +6 4952	+399
	2	.939 6264 5 6145	2867	.289 6379 15 0664	871	.125 6067 6 5333	381
	3	.945 2409 5 3265	2880	.274 5715 15 1488	824	.119 0734 6 5690	357
	4	.950 5674 5 0372	2893	.259 4227 15 2262	774	.112 5044 6 6027	337
	5	.955 6046 4 7471	2901	.244 1965 15 2989	727	.105 9017 6 6345	318
	6	+0.960 3517 + 4 4560	-2911	-0.228 8976 +15 3669	+680	-0.099 2672 +6 6639	+294
	7	.964 8077 4 1640	2920	.213 5307 15 4301	632	.092 6033 6 6916	277
	8	.968 9717 3 8713	2927	.198 1006 15 4887	586	.085 9117 6 7172	256
	9	.972 8430 3 5781	2932	.182 6119 15 5426	539	.079 1945 6 7407	235
	10	.976 4211 3 2839	2942	.167 0693 15 5917	491	.072 4538 6 7620	213
	11	+0.979 7050 + 2 9898	-2941	-0.151 4776 +15 6367	+450	-0.065 6918 +6 7816	+196
	12	.982 6948 2 6949	2949	.135 8409 15 6769	402	.058 9102 6 7992	176
	13	.985 3897 2 3998	2951	.120 1640 15 7128	359	.052 1110 6 8147	155
	14	.987 7895 2 1043	2955	.104 4512 15 7443	315	.045 2963 6 8284	137
	15	.989 8938 1 8079	2964	.088 7069 15 7714	271	.038 4679 6 8401	117
	16	+0.991 7017 + 1 5117	-2962	-0.072 9355 +15 7941	+227	-0.031 6278 +6 8498	+97
	17	.993 2134 1 2147	2970	.057 1414 15 8126	185	.024 7780 6 8576	78
	18	.994 4281 9173	2974	.041 3288 15 8262	136	.017 9204 6 8635	59
	19	.995 3454 6194	2979	.025 5026 15 8356	94	.011 0569 6 8674	39
	20	.995 9648 3214	2980	-.009 6670 15 8400	+44	-.004 1895 6 8691	+17
	21	+0.996 2862 + 231	-2983	+0.006 1730 +15 8399	-1	+0.002 6796 +6 8688	-3
	22	.996 3093 - 2755	2986	.022 0129 15 8349	50	.009 5484 6 8665	23
	23	.996 0338 5742	2987	.037 8478 15 8249	100	.016 4149 6 8620	45
	24	.995 4596 8726	2984	.053 6727 15 8098	151	.023 2769 6 8555	65
	25	.994 5870 1 1705	2979	.069 4825 15 7898	200	.030 1324 6 8467	88
	26	+0.993 4165 - 1 4683	-2978	+0.085 2723 +15 7648	-250	+0.036 9791 +6 8358	-109
	27	.991 9482 1 7650	2967	.101 0371 15 7345	303	.043 8149 6 8227	131
	28	.990 1832 2 0614	2964	.116 7716 15 6994	351	.050 6376 6 8076	151
	29	.988 1218 2 3560	2946	.132 4710 15 6594	400	.057 4452 6 7903	173
	30	.985 7658 2 6501	2941	.148 1304 15 6144	450	.064 2355 6 7709	194
Apr.	31	+0.983 1157 - 2 9426	-2925	+0.163 7448 +15 5645	-499	+0.071 0064 +6 7495	-214
	1	+0.980 1731 - 2 9099	-2909	+0.179 3093 +15 543	-543	+0.077 7559 +6 7495	-236

FOR 0^h EPHEMERIS TIME
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Date		X		Y		Z	
Apr.	1	+0.980 1731	-2909	+0.179 3093	-543	+0.077 7559	-236
	2	.976 9396	3 2335 2897	.194 8195	+15 5102 591	.084 4818	+6 7259 254
	3	.973 4164	3 5232 2881	.210 2706	15 4511 636	.091 1823	6 7005 275
	4	.969 6051	3 8113 2864	.225 6581	15 3875 680	.097 8553	6 6730 292
	5	.965 5074	4 0977 2847	.240 9776	15 3195 727	.104 4991	6 6438 315
			4 3824		15 2468		6 6123
	6	+0.961 1250	-2826	+0.256 2244	-766	+0.111 1114	-331
	7	.956 4600	4 6650 2810	.271 3946	+15 1702 813	.117 6906	+6 5792 350
	8	.951 5140	4 9460 2790	.286 4835	15 0889 849	.124 2348	6 5442 369
	9	.946 2890	5 2250 2769	.301 4875	15 0040 894	.130 7421	6 5073 388
	10	.940 7871	5 5019 2749	.316 4021	14 9146 931	.137 2106	6 4685 403
			5 7768		14 8215		6 4282
	11	+0.935 0103	-2733	+0.331 2236	-971	+0.143 6388	-421
	12	.928 9602	6 0501 2710	.345 9480	+14 7244 1008	.150 0249	+6 3861 439
	13	.922 6391	6 3211 2694	.360 5716	14 6236 1046	.156 3671	6 3422 455
	14	.916 0486	6 5905 2674	.375 0906	14 5190 1087	.162 6638	6 2967 472
	15	.909 1907	6 8579 2657	.389 5009	14 4103 1124	.168 9133	6 2495 490
			7 1236		14 2979		6 2005
	16	+0.902 0671	-2636	+0.403 7988	-1166	+0.175 1138	-506
	17	.894 6799	7 3872 2619	.417 9801	+14 1813 1203	.181 2637	+6 1499 525
	18	.887 0308	7 6491 2597	.432 0411	14 0610 1247	.187 3611	6 0974 542
	19	.879 1220	7 9088 2574	.445 9774	13 9363 1289	.193 4043	6 0432 560
	20	.870 9558	8 1662 2555	.459 7848	13 8074 1331	.199 3915	5 9872 578
			8 4217		13 6743		5 9294
	21	+0.862 5341	-2528	+0.473 4591	-1370	+0.205 3209	-596
	22	.853 8596	8 6745 2502	.486 9964	+13 5373 1415	.211 1907	+5 8698 612
	23	.844 9349	8 9247 2473	.500 3922	13 3958 1456	.216 9993	5 8086 632
	24	.835 7629	9 1720 2447	.513 6424	13 2502 1496	.222 7447	5 7454 648
	25	.826 3462	9 4167 2414	.526 7430	13 1006 1535	.228 4253	5 6806 666
			9 6581		12 9471		5 6140
	26	+0.816 6881	-2382	+0.539 6901	-1576	+0.234 0393	-682
	27	.806 7918	9 8963 2350	.552 4796	+12 7895 1613	.239 5851	+5 5458 697
	28	.796 6605	10 1313 2316	.565 1078	12 6282 1650	.245 0612	5 4761 716
	29	.786 2976	10 3629 2281	.577 5710	12 4632 1686	.250 4657	5 4045 729
	30	.775 7066	10 5910 2245	.589 8656	12 2946 1721	.255 7973	5 3316 745
			10 8155		12 1225		5 2571
May	1	+0.764 8911	-2210	+0.601 9881	-1753	+0.261 0544	-758
	2	.753 8546	11 0365 2173	.613 9353	+11 9472 1788	.266 2357	+5 1813 774
	3	.742 6008	11 2538 2137	.625 7037	11 7684 1819	.271 3396	5 1039 789
	4	.731 1333	11 4675 2098	.637 2902	11 5865 1848	.276 3646	5 0250 799
	5	.719 4560	11 6773 2061	.648 6919	11 4017 1879	.281 3097	4 9451 815
			11 8834		11 2138		4 8636
	6	+0.707 5726	-2024	+0.659 9057	-1908	+0.286 1733	-826
	7	.695 4868	12 0858 1986	.670 9287	+11 0230 1933	.290 9543	+4 7810 839
	8	.683 2024	12 2844 1948	.681 7584	10 8297 1960	.295 6514	4 6971 851
	9	.670 7232	12 4792 1912	.692 3921	10 6337 1984	.300 2634	4 6120 860
	10	.658 0528	12 6704 1874	.702 8274	10 4353 2011	.304 7894	4 5260 873
			12 8578		10 2342		4 4387
	11	+0.645 1950	-1841	+0.713 0616	-2034	+0.309 2281	-884
	12	.632 1531	13 0419 1805	.723 0924	+10 0308 2058	.313 5784	+4 3503 894
	13	.618 9307	13 2224 1770	.732 9174	9 8250 2085	.317 8393	4 2609 907
	14	.605 5313	13 3994 1736	.742 5339	9 6165 2110	.322 0095	4 1702 916
	15	.591 9583	13 5730 1700	.751 9394	9 4055 2136	.326 0881	4 0786 928
			13 7430		9 1919		3 9858
	16	+0.578 2153	-1664	+0.761 1313	-2164	+0.330 0739	-940
	17	+0.564 3059	-1626	+0.770 1068	+8 9755 -2190	+0.333 9657	+3 8918 -950

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1960.0

Date	X			Y			Z		
May 17	+0.564 3059	-14 0720	-1626	+0.770 1068	+ 8 7565	-2190	+0.333 9657	+3 7968	- 950
18	.550 2339	14 2306	1586	.778 8633	8 5347	2218	.337 7625	3 7004	964
19	.536 0033	14 3854	1548	.787 3980	8 3103	2244	.341 4629	3 6032	972
20	.521 6179	14 5358	1504	.795 7083	8 0835	2268	.345 0661	3 5047	985
21	.507 0821	14 6821	1463	.803 7918	7 8537	2298	.348 5708	3 4052	995
22	+0.492 4000	-14 8239	-1418	+0.811 6455	+ 7 6219	-2318	+0.351 9760	+3 3049	-1003
23	.477 5761	14 9614	1375	.819 2674	7 3876	2343	.355 2809	3 2032	1017
24	.462 6147	15 0941	1327	.826 6550	7 1513	2363	.358 4841	3 1008	1024
25	.447 5206	15 2222	1281	.833 8063	6 9126	2387	.361 5849	2 9976	1032
26	.432 2984	15 3458	1236	.840 7189	6 6722	2404	.364 5825	2 8932	1044
27	+0.416 9526	-15 4645	-1187	+0.847 3911	+ 6 4297	-2425	+0.367 4757	+2 7885	-1047
28	.401 4881	15 5786	1141	.853 8208	6 1859	2438	.370 2642	2 6827	1058
29	.385 9095	15 6877	1091	.860 0067	5 9401	2458	.372 9469	2 5764	1063
30	.370 2218	15 7923	1046	.865 9468	5 6931	2470	.375 5233	2 4693	1071
31	.354 4295	15 8919	996	.871 6399	5 4446	2485	.377 9926	2 3617	1076
June 1	+0.338 5376	-15 9866	- 947	+0.877 0845	+ 5 1949	-2497	+0.380 3543	+2 2535	-1082
2	.322 5510	16 0769	903	.882 2794	4 9440	2509	.382 6078	2 1447	1088
3	.306 4741	16 1620	851	.887 2234	4 6922	2518	.384 7525	2 0355	1092
4	.290 3121	16 2426	806	.891 9156	4 4396	2526	.386 7880	1 9259	1096
5	.274 0695	16 3186	760	.896 3552	4 1861	2535	.388 7139	1 8159	1100
6	+0.257 7509	-16 3900	- 714	+0.900 5413	+ 3 9318	-2543	+0.390 5298	+1 7056	-1103
7	.241 3609	16 4569	669	.904 4731	3 6771	2547	.392 2354	1 5949	1107
8	.224 9040	16 5196	627	.908 1502	3 4217	2554	.393 8303	1 4841	1108
9	.208 3844	16 5777	581	.911 5719	3 1654	2563	.395 3144	1 3727	1114
10	.191 8067	16 6320	543	.914 7373	2 9087	2567	.396 6871	1 2613	1114
11	+0.175 1747	-16 6818	- 498	+0.917 6460	+ 2 6511	-2576	+0.397 9484	+1 1493	-1120
12	.158 4929	16 7273	455	.920 2971	2 3927	2584	.399 0977	1 0372	1121
13	.141 7656	16 7686	413	.922 6898	2 1335	2592	.400 1349	9246	1126
14	.124 9970	16 8053	367	.924 8233	1 8733	2602	.401 0595	8116	1130
15	.108 1917	16 8374	321	.926 6966	1 6123	2610	.401 8711	6986	1130
16	+0.091 3543	-16 8648	- 274	+0.928 3089	+ 1 3506	-2617	+0.402 5697	+ 5850	-1136
17	.074 4895	16 8876	228	.929 6595	1 0882	2624	.403 1547	4712	1138
18	.057 6019	16 9053	177	.930 7477	8252	2630	.403 6259	3573	1139
19	.040 6966	16 9181	128	.931 5729	5617	2635	.403 9832	2431	1142
20	.023 7785	16 9259	78	.932 1346	2980	2637	.404 2263	1289	1142
21	+0.006 8526	-16 9286	- 27	+0.932 4326	+ 340	-2640	+0.404 3552	+ 146	-1143
22	-.010 0760	16 9265	+ 21	.932 4666	2301	2641	.404 3698	999	1145
23	.027 0025	16 9190	75	.932 2365	4941	2640	.404 2699	2143	1144
24	.043 9215	16 9067	123	.931 7424	7579	2638	.404 0556	3284	1141
25	.060 8282	16 8892	175	.930 9845	1 0216	2637	.403 7272	4427	1143
26	-0.077 7174	-16 8668	+ 224	+0.929 9629	+ 1 2847	-2631	+0.403 2845	+ 5566	-1139
27	.094 5842	16 8391	277	.928 6782	1 5473	2626	.402 7279	6706	1140
28	.111 4233	16 8069	322	.927 1309	1 8093	2620	.402 0573	7840	1134
29	.128 2302	16 7693	376	.925 3216	2 0707	2614	.401 2733	8972	1132
30	.144 9995	16 7270	423	.923 2509	2 3309	2602	.400 3761	1 0102	1130
July 1	-0.161 7265	-16 6798	+ 472	+0.920 9200	+ 2 5903	-2594	+0.399 3659	-1 1226	-1124
2	-0.178 4063	+ 518	+ 518	+0.918 3297	- 2 5903	-2584	+0.398 2433		-1122

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1960.0

Date		X			Y			Z		
July	1	-0.161 7265	-16 6798	+ 472	+0.920 9200	- 2 5903	-2594	+0.399 3659	-1 1226	-1124
	2	.178 4063	16 6280	518	.918 3297	2 8487	2584	.398 2433	1 2348	1122
	3	.195 0343	16 5715	565	.915 4810	3 1057	2570	.397 0085	1 3463	1115
	4	.211 6058	16 5106	609	.912 3753	3 3617	2560	.395 6622	1 4574	1111
	5	.228 1164	16 4450	656	.909 0136	3 6162	2545	.394 2048	1 5680	1106
	6	-0.244 5614	-16 3755	+ 695	+0.905 3974	- 3 8695	-2533	+0.392 6368	-1 6781	-1101
	7	.260 9369	16 3017	738	.901 5279	4 1217	2522	.390 9587	1 7875	1094
	8	.277 2386	16 2236	781	.897 4062	4 3725	2508	.389 1712	1 8964	1089
	9	.293 4622	16 1418	818	.893 0337	4 6224	2499	.387 2748	2 0050	1086
	10	.309 6040	16 0555	863	.888 4113	4 8711	2487	.385 2698	2 1130	1080
	11	-0.325 6595	-15 9651	+ 904	+0.883 5402	- 5 1187	-2476	+0.383 1568	-2 2205	-1075
	12	.341 6246	15 8706	945	.878 4215	5 3653	2466	.380 9363	2 3274	1069
	13	.357 4952	15 7717	989	.873 0562	5 6109	2456	.378 6089	2 4340	1066
	14	.373 2669	15 6680	1037	.867 4453	5 8554	2445	.376 1749	2 5398	1058
	15	.388 9349	15 5603	1077	.861 5899	6 0986	2432	.373 6351	2 6453	1055
	16	-0.404 4952	-15 4475	+1128	+0.855 4913	- 6 3403	-2417	+0.370 9898	-2 7501	-1048
	17	.419 9427	15 3304	1171	.849 1510	6 5807	2404	.368 2397	2 8541	1040
	18	.435 2731	15 2087	1217	.842 5703	6 8193	2386	.365 3856	2 9575	1034
	19	.450 4818	15 0822	1265	.835 7510	7 0561	2368	.362 4281	3 0600	1025
	20	.465 5640	14 9512	1310	.828 6949	7 2912	2351	.359 3681	3 1619	1019
	21	-0.480 5152	-14 8159	+1353	+0.821 4037	- 7 5244	-2332	+0.356 2062	-3 2628	-1009
	22	.495 3311	14 6758	1401	.813 8793	7 7552	2308	.352 9434	3 3629	1001
	23	.510 0069	14 5313	1445	.806 1241	7 9840	2288	.349 5805	3 4618	989
	24	.524 5382	14 3826	1487	.798 1401	8 2105	2265	.346 1187	3 5600	982
	25	.538 9208	14 2293	1533	.789 9296	8 4345	2240	.342 5587	3 6571	971
	26	-0.553 1501	-14 0717	+1576	+0.781 4951	- 8 6561	-2216	+0.338 9016	-3 7531	-960
	27	.567 2218	13 9101	1616	.772 8390	8 8748	2187	.335 1485	3 8479	948
	28	.581 1319	13 7441	1660	.763 9642	9 0909	2161	.331 3006	3 9417	938
	29	.594 8760	13 5746	1695	.754 8733	9 3042	2133	.327 3589	4 0342	925
	30	.608 4506	13 4008	1738	.745 5691	9 5144	2102	.323 3247	4 1255	913
	31	-0.621 8514	-13 2235	+1773	+0.736 0547	- 9 7219	-2075	+0.319 1992	-4 2156	-901
Aug.	1	.635 0749	13 0425	1810	.726 3328	9 9264	2045	.314 9836	4 3044	888
	2	.648 1174	12 8581	1844	.716 4064	10 1277	2013	.310 6792	4 3918	874
	3	.660 9755	12 6703	1878	.706 2787	10 3261	1984	.306 2874	4 4781	863
	4	.673 6458	12 4793	1910	.695 9526	10 5214	1953	.301 8093	4 5630	849
	5	-0.686 1251	-12 2853	+1940	+0.685 4312	-10 7144	-1930	+0.297 2463	-4 6469	-839
	6	.698 4104	12 0880	1973	.674 7168	10 9039	1895	.292 5994	4 7292	823
	7	.710 4984	11 8876	2004	.663 8129	11 0911	1872	.287 8702	4 8104	812
	8	.722 3860	11 6841	2035	.652 7218	11 2755	1844	.283 0598	4 8903	799
	9	.734 0701	11 4773	2068	.641 4463	11 4570	1815	.278 1695	4 9692	789
	10	-0.745 5474	-11 2672	+2101	+0.629 9893	-11 6360	-1790	+0.273 2003	-5 0469	-777
	11	.756 8146	11 0537	2135	.618 3533	11 8121	1761	.268 1534	5 1230	761
	12	.767 8683	10 8368	2169	.606 5412	11 9851	1730	.263 0304	5 1981	751
	13	.778 7051	10 6164	2204	.594 5561	12 1554	1703	.257 8323	5 2717	736
	14	.789 3215	10 3928	2236	.582 4007	12 3224	1670	.252 5606	5 3439	722
	15	-0.799 7143	-10 1657	+2271	+0.570 0783	-12 4860	-1636	+0.247 2167	-5 4148	-709
	16	-0.809 8800	-10 0000	+2305	+0.557 5923	-12 6503	-1603	+0.241 8019	-5 4869	-694

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MEAN EQUATOR AND EQUINOX OF 1960-0

Date	X			Y			Z		
Aug. 16	-0.809 8800			+0.557 5923		-1603	+0.241 8019		
17	.819 8152	- 9 9352	+2305	.544 9460	-12 6463	1567	.236 3177	-5 4842	- 694
18	.829 5167	9 7015	2337	.532 1430	12 8030	1534	.230 7657	5 5520	678
19	.838 9814	9 4647	2368	.519 1866	12 9564	1495	.225 1474	5 6183	663
20	.848 2061	9 2247	2400	.506 0807	13 1059	1458	.219 4644	5 6830	647
		8 9816	2431		13 2517			5 7461	631
21	-0.857 1877	- 8 7357	+2459	+0.492 8290	-13 3935	-1418	+0.213 7183	-5 8077	- 616
22	.865 9234	8 4867	2490	.479 4355	13 5314	1379	.207 9106	5 8674	597
23	.874 4101	8 2350	2517	.465 9041	13 6655	1341	.202 0432	5 9255	581
24	.882 6451	7 9807	2543	.452 2386	13 7952	1297	.196 1177	5 9816	561
25	.890 6258	7 7238	2569	.438 4434	13 9209	1257	.190 1361	6 0363	547
26	-0.898 3496	- 7 4647	+2591	+0.424 5225	-14 0420	-1211	+0.184 0998	-6 0888	- 525
27	.905 8143	7 2032	2615	.410 4805	14 1591	1171	.178 0110	6 1398	510
28	.913 0175	6 9399	2633	.396 3214	14 2718	1127	.171 8712	6 1888	490
29	.919 9574	6 6745	2654	.382 0496	14 3803	1085	.165 6824	6 2360	472
30	.926 6319	6 4075	2670	.367 6693	14 4844	1041	.159 4464	6 2814	454
31	-0.933 0394	- 6 1388	+2687	+0.353 1849	-14 5844	-1000	+0.153 1650	-6 3248	- 434
Sept. 1	.939 1782	5 8685	2703	.338 6005	14 6801	957	.146 8402	6 3666	418
2	.945 0467	5 5968	2717	.323 9204	14 7720	919	.140 4736	6 4066	400
3	.950 6435	5 3237	2731	.309 1484	14 8598	878	.134 0670	6 4447	381
4	.955 9672	5 0492	2745	.294 2886	14 9436	838	.127 6223	6 4811	364
5	-0.961 0164	- 4 7734	+2758	+0.279 3450	-15 0235	- 799	+0.121 1412	-6 5158	- 347
6	.965 7898	4 4959	2775	.264 3215	15 0998	763	.114 6254	6 5489	331
7	.970 2857	4 2170	2789	.249 2217	15 1718	720	.108 0765	6 5801	312
8	.974 5027	3 9365	2805	.234 0499	15 2402	684	.101 4964	6 6096	295
9	.978 4392	3 6543	2822	.218 8097	15 3044	642	.094 8868	6 6374	278
10	-0.982 0935	- 3 3709	+2834	+0.203 5053	-15 3644	- 600	+0.088 2494	-6 6633	- 259
11	.985 4644	3 0857	2852	.188 1409	15 4205	561	.081 5861	6 6874	241
12	.988 5501	2 7993	2864	.172 7204	15 4717	512	.074 8987	6 7095	221
13	.991 3494	2 5114	2879	.157 2487	15 5190	473	.068 1892	6 7298	203
14	.993 8608	2 2222	2892	.141 7297	15 5616	426	.061 4594	6 7482	184
15	-0.996 0830	- 1 9319	+2903	+0.126 1681	-15 5996	- 380	+0.054 7112	-6 7645	- 163
16	.998 0149	1 6406	2913	.110 5685	15 6332	336	.047 9467	6 7789	144
17	.999 6555	1 3483	2923	.094 9353	15 6618	286	.041 1678	6 7914	125
18	1.001 0038	1 0550	2933	.079 2735	15 6860	242	.034 3764	6 8017	103
19	1.002 0588	7610	2940	.063 5875	15 7051	191	.027 5747	6 8100	83
20	-1.002 8198	- 4665	+2945	+0.047 8824	-15 7195	- 144	+0.020 7647	-6 8162	- 62
21	1.003 2863	1715	2950	.032 1629	15 7290	95	.013 9485	6 8203	41
22	1.003 4578	1239	2954	.016 4339	15 7335	45	.007 1282	6 8224	21
23	1.003 3339	4195	2956	+ .000 7004	15 7330	5	+ .000 3058	6 8223	1
24	1.002 9144	7147	2952	- .015 0326	15 7275	55	- .006 5165	6 8223	24
25	-1.002 1997	+ 1 0100	+2953	-0.030 7601	-15 7171	+ 104	-0.013 3364	-6 8157	+ 42
26	1.001 1897	1 3047	2947	.046 4772	15 7020	151	.020 1521	6 8094	63
27	.999 8850	1 5990	2943	.062 1792	15 6822	198	.026 9615	6 8007	87
28	.998 2860	1 8925	2935	.077 8614	15 6574	248	.033 7622	6 7904	103
29	.996 3935	2 1854	2929	.093 5188	15 6284	290	.040 5526	6 7779	125
30	-0.994 2081	+ 2 4776	+2922	-0.109 1472	-15 5948	+ 336	-0.047 3305	-6 7634	+ 145
Oct. 1	-0.991 7305	+2913	+2913	-0.124 7420		+ 379	-0.054 0939	+ 164	

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1960.0

Date	X			Y			Z		
Oct. 1	-0.991 7305	+ 2 7689	+2913	-0.124 7420	-15 5569	+ 379	-0.054 0939	-6 7470	+ 164
2	.988 9616	3 0593	2904	.140 2989	15 5146	423	.060 8409	6 7288	182
3	.985 9023	3 3491	2898	.155 8135	15 4682	464	.067 5697	6 7086	202
4	.982 5532	3 6380	2889	.171 2817	15 4173	509	.074 2783	6 6866	220
5	.978 9152	3 9260	2880	.186 6990	15 3626	547	.080 9649	6 6627	239
6	-0.974 9892	+ 4 2136	+2876	-0.202 0616	-15 3034	+ 592	-0.087 6276	-6 6370	+ 257
7	.970 7756	4 5000	2864	.217 3650	15 2399	635	.094 2646	6 6093	277
8	.966 2756	4 7859	2859	.232 6049	15 1720	679	.100 8739	6 5798	295
9	.961 4897	5 0708	2849	.247 7769	15 0999	721	.107 4537	6 5482	316
10	.956 4189	5 3550	2842	.262 8768	15 0231	768	.114 0019	6 5148	334
11	-0.951 0639	+ 5 6378	+2828	-0.277 8999	-14 9417	+ 814	-0.120 5167	-6 4794	+ 354
12	.945 4261	5 9198	2820	.292 8416	14 8561	856	.126 9961	6 4421	373
13	.939 5063	6 2004	2806	.307 6977	14 7654	907	.133 4382	6 4027	394
14	.933 3059	6 4796	2792	.322 4631	14 6706	948	.139 8409	6 3615	412
15	.926 8263	6 7575	2779	.337 1337	14 5707	999	.146 2024	6 3181	434
16	-0.920 0688	+ 7 0337	+2762	-0.351 7044	-14 4665	+1042	-0.152 5205	-6 2728	+ 453
17	.913 0351	7 3083	2746	.366 1709	14 3574	1091	.158 7933	6 2256	472
18	.905 7268	7 5809	2726	.380 5283	14 2438	1136	.165 0189	6 1762	494
19	.898 1459	7 8517	2708	.394 7721	14 1253	1185	.171 1951	6 1250	512
20	.890 2942	8 1201	2684	.408 8974	14 0021	1232	.177 3201	6 0716	534
21	-0.882 1741	+ 8 3865	+2664	-0.422 8995	-13 8742	+1279	-0.183 3917	-6 0163	+ 553
22	.873 7876	8 6499	2634	.436 7737	13 7418	1324	.189 4080	5 9591	572
23	.865 1377	8 9107	2608	.450 5155	13 6049	1369	.195 3671	5 8997	594
24	.856 2270	9 1689	2582	.464 1204	13 4636	1413	.201 2668	5 8388	609
25	.847 0581	9 4237	2548	.477 5840	13 3182	1454	.207 1056	5 7759	629
26	-0.837 6344	+ 9 6757	+2520	-0.490 9022	-13 1686	+1496	-0.212 8815	-5 7110	+ 649
27	.827 9587	9 9246	2489	.504 0708	13 0151	1535	.218 5925	5 6447	663
28	.818 0341	10 1704	2458	.517 0859	12 8579	1572	.224 2372	5 5766	681
29	.807 8637	10 4129	2425	.529 9438	12 6968	1611	.229 8138	5 5068	698
30	.797 4508	10 6525	2396	.542 6406	12 5323	1645	.235 3206	5 4354	714
31	-0.786 7983	+10 8888	+2363	-0.555 1729	-12 3642	+1681	-0.240 7560	-5 3625	+ 729
Nov. 1	.775 9095	11 1221	2333	.567 5371	12 1925	1717	.246 1185	5 2881	744
2	.764 7874	11 3524	2303	.579 7296	12 0174	1751	.251 4066	5 2119	762
3	.753 4350	11 5796	2272	.591 7470	11 8389	1785	.256 6185	5 1344	775
4	.741 8554	11 8036	2240	.603 5859	11 6567	1822	.261 7529	5 0554	790
5	-0.730 0518	+12 0246	+2210	-0.615 2426	-11 4712	+1855	-0.266 8083	-4 9747	+ 807
6	.718 0272	12 2425	2179	.626 7138	11 2821	1891	.271 7830	4 8925	822
7	.705 7847	12 4571	2146	.637 9959	11 0893	1928	.276 6755	4 8088	837
8	.693 3276	12 6683	2112	.649 0852	10 8933	1960	.281 4843	4 7236	852
9	.680 6593	12 8761	2078	.659 9785	10 6935	1998	.286 2079	4 6369	867
10	-0.667 7832	+13 0804	+2043	-0.670 6720	-10 4902	+2033	-0.290 8448	-4 5487	+ 882
11	.654 7028	13 2813	2009	.681 1622	10 2833	2069	.295 3935	4 4588	899
12	.641 4215	13 4782	1969	.691 4455	10 0732	2101	.299 8523	4 3677	911
13	.627 9433	13 6714	1932	.701 5187	9 8594	2138	.304 2200	4 2750	927
14	.614 2719	13 8608	1894	.711 3781	9 6424	2170	.308 4950	4 1808	942
15	-0.600 4111	+14 0460	+1852	-0.721 0205	-9 4216	+2208	-0.312 6758	-4 0852	+ 956
16	-0.586 3651	+14 2212	+1812	-0.730 4421	-9 2238	+2238	-0.316 7610	-4 0000	+ 970

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1960.0

Date	X			Y			Z		
Nov. 16	-0.586 3651	+14 2272	+1812	-0.730 4421	- 9 1978	+2238	-0.316 7610	-3 9882	+ 970
17	.572 1379	14 4039	1767	.739 6399	8 9704	2274	.320 7492	3 8897	985
18	.557 7340	14 5761	1722	.748 6103	8 7397	2307	.324 6389	3 7898	999
19	.543 1579	14 7437	1676	.757 3500	8 5060	2337	.328 4287	3 6887	1011
20	.528 4142	14 9064	1627	.765 8560	8 2695	2365	.332 1174	3 5862	1025
21	-0.513 5078	+15 0642	+1578	-0.774 1255	- 8 0300	+2395	-0.335 7036	-3 4825	+1037
22	.498 4436	15 2170	1528	.782 1555	7 7881	2419	.339 1861	3 3778	1047
23	.483 2266	15 3648	1478	.789 9436	7 5435	2446	.342 5639	3 2719	1059
24	.467 8618	15 5076	1428	.797 4871	7 2971	2464	.345 8358	3 1651	1068
25	.452 3542	15 6454	1378	.804 7842	7 0483	2488	.349 0009	3 0572	1079
26	-0.436 7088	+15 7783	+1329	-0.811 8325	- 6 7978	+2505	-0.352 0581	-2 9487	+1085
27	.420 9305	15 9063	1280	.818 6303	6 5452	2526	.355 0068	2 8390	1097
28	.405 0242	16 0295	1232	.825 1755	6 2910	2542	.357 8458	2 7288	1102
29	.388 9947	16 1481	1186	.831 4665	6 0350	2560	.360 5746	2 6176	1112
30	.372 8466	16 2616	1135	.837 5015	5 7774	2576	.363 1922	2 5059	1117
Dec. 1	-0.356 5850	+16 3707	+1091	-0.843 2789	- 5 5180	+2594	-0.365 6981	-2 3932	+1127
2	.340 2143	16 4748	1041	.848 7969	5 2571	2609	.368 0913	2 2798	1134
3	.323 7395	16 5744	996	.854 0540	4 9944	2624	.370 3711	2 1659	1139
4	.307 1651	16 6691	947	.859 0484	4 7302	2642	.372 5370	2 0512	1147
5	.290 4960	16 7591	900	.863 7786	4 4646	2656	.374 5882	1 9357	1155
6	-0.273 7369	+16 8442	+ 851	-0.868 2432	- 4 1970	+2676	-0.376 5239	-1 8197	+1160
7	.256 8927	16 9244	802	.872 4402	3 9282	2688	.378 3436	1 7030	1167
8	.239 9683	16 9998	754	.876 3684	3 6579	2703	.380 0466	1 5857	1173
9	.222 9685	17 0698	700	.880 0263	3 3861	2718	.381 6323	1 4678	1179
10	.205 8987	17 1350	652	.883 4124	3 1129	2732	.383 1001	1 3493	1185
11	-0.188 7637	+17 1950	+ 600	-0.886 5253	- 2 8386	+2743	-0.384 4494	-1 2303	+1190
12	.171 5687	17 2498	548	.889 3639	2 5626	2760	.385 6797	1 1108	1195
13	.154 3189	17 2993	495	.891 9265	2 2858	2768	.386 7905	9907	1201
14	.137 0196	17 3433	440	.894 2123	2 0075	2783	.387 7812	8702	1205
15	.119 6763	17 3820	387	.896 2198	1 7285	2790	.388 6514	7493	1209
16	-0.102 2943	+17 4147	+ 327	-0.897 9483	- 1 4482	+2803	-0.389 4007	- 6280	+1213
17	.084 8796	17 4420	273	.899 3965	1 1673	2809	.390 0287	5063	1217
18	.067 4376	17 4631	211	.900 5638	8859	2814	.390 5350	3843	1220
19	.049 9745	17 4787	156	.901 4497	6039	2820	.390 9193	2624	1219
20	.032 4958	17 4879	92	.902 0536	3220	2819	.391 1817	1401	1223
21	-0.015 0079	+17 4918	+ 39	-0.902 3756	- 401	+2819	-0.391 3218	- 180	+1221
22	+ .002 4839	17 4895	- 23	.902 4157	2418	2819	.391 3398	1041	1221
23	.019 9734	17 4817	78	.902 1739	5230	2812	.391 2357	2261	1220
24	.037 4551	17 4683	134	.901 6509	8038	2808	.391 0096	3479	1218
25	.054 9234	17 4496	187	.900 8471	1 0840	2802	.390 6617	4695	1216
26	+0.072 3730	+17 4256	- 240	-0.899 7631	- 1 3635	+2795	-0.390 1922	- 5907	+1212
27	.089 7986	17 3960	296	.898 3996	1 6424	2789	.389 6015	7118	1211
28	.107 1946	17 3615	345	.896 7572	1 9204	2780	.388 8897	8326	1208
29	.124 5561	17 3218	397	.894 8368	2 1979	2775	.388 0571	9530	1204
30	.141 8779	17 2771	447	.892 6389	2 4742	2763	.387 1041	1 0729	1199
31	+0.159 1550	+17 2271	- 500	-0.890 1647	- 2 7501	+2759	-0.386 0312	- 1 1928	+1199
32	+0.176 3821	- 547	- 547	-0.887 4146	+ 2 7501	+2747	-0.384 8384	+1 1928	+1193

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Date		X_{1950}			Y_{1950}			Z_{1950}		
Jan.	0	+0.143 9939	+17 2844	- 455	-0.892 4049	+ 2 5090	+2794	-0.386 9980	+1 0876	+1210
	1	.161 2783	17 2331	513	.889 8959	2 7871	2781	.385 9104	1 2082	1206
	2	.178 5114	17 1760	571	.887 1088	3 0644	2773	.384 7022	1 3283	1201
	3	.195 6874	17 1135	625	.884 0444	3 3401	2757	.383 3739	1 4477	1194
	4	.212 8009	17 0456	679	.880 7043	3 6146	2745	.381 9262	1 5668	1191
	5	+0.229 8465	+16 9725	- 731	-0.877 0897	+ 3 8875	+2729	-0.380 3594	+1 6851	+1183
	6	.246 8190	16 8941	784	.873 2022	4 1587	2712	.378 6743	1 8029	1178
	7	.263 7131	16 8108	833	.869 0435	4 4287	2700	.376 8714	1 9199	1170
	8	.280 5239	16 7223	885	.864 6148	4 6968	2681	.374 9515	2 0363	1164
	9	.297 2462	16 6288	935	.859 9180	4 9633	2665	.372 9152	2 1520	1157
	10	+0.313 8750	+16 5306	- 982	-0.854 9547	+ 5 2280	+2647	-0.370 7632	+2 2670	+1150
	11	.330 4056	16 4274	1032	.849 7267	5 4911	2631	.368 4962	2 3812	1142
	12	.346 8330	16 3196	1078	.844 2356	5 7526	2615	.366 1150	2 4947	1135
	13	.363 1526	16 2068	1128	.838 4830	6 0119	2593	.363 6203	2 6072	1125
	14	.379 3594	16 0894	1174	.832 4711	6 2694	2575	.361 0131	2 7191	1119
	15	+0.395 4488	+15 9671	-1223	-0.826 2017	+ 6 5251	+2557	-0.358 2940	+2 8302	+1111
	16	.411 4159	15 8405	1266	.819 6766	6 7792	2541	.355 4638	2 9404	1102
	17	.427 2564	15 7090	1315	.812 8974	7 0312	2520	.352 5234	3 0497	1093
	18	.442 9654	15 5728	1362	.805 8662	7 2811	2499	.349 4737	3 1581	1084
	19	.458 5382	15 4319	1409	.798 5851	7 5292	2481	.346 3156	3 2658	1077
	20	+0.473 9701	+15 2865	-1454	-0.791 0559	+ 7 7750	+2458	-0.343 0498	+3 3724	+1066
	21	.489 2566	15 1360	1505	.783 2809	8 0190	2440	.339 6774	3 4780	1056
	22	.504 3926	14 9808	1552	.775 2619	8 2607	2417	.336 1994	3 5827	1047
	23	.519 3734	14 8208	1600	.767 0012	8 5000	2393	.332 6167	3 6864	1037
	24	.534 1942	14 6557	1651	.758 5012	8 7370	2370	.328 9303	3 7890	1026
	25	+0.548 8499	+14 4858	-1699	-0.749 7642	+ 8 9713	+2343	-0.325 1413	+3 8903	+1013
	26	.563 3357	14 3111	1747	.740 7929	9 2025	2312	.321 2510	3 9906	1003
	27	.577 6468	14 1314	1797	.731 5904	9 4309	2284	.317 2604	4 0895	989
	28	.591 7782	13 9473	1841	.722 1595	9 6564	2255	.313 1709	4 1870	975
	29	.605 7255	13 7581	1892	.712 5031	9 8780	2216	.308 9839	4 2830	960
	30	+0.619 4836	+13 5648	-1933	-0.702 6251	+10 0964	+2184	-0.304 7009	+4 3777	+ 947
	31	.633 0484	13 3673	1975	.692 5287	10 3110	2146	.300 3232	4 4708	931
Feb.	1	.646 4157	13 1656	2017	.682 2177	10 5222	2112	.295 8524	4 5623	915
	2	.659 5813	12 9601	2055	.671 6955	10 7295	2073	.291 2901	4 6523	900
	3	.672 5414	12 7508	2093	.660 9660	10 9331	2036	.286 6378	4 7408	885
	4	+0.685 2922	+12 5378	-2130	-0.650 0329	+11 1332	+2001	-0.281 8970	+4 8274	+ 866
	5	.697 8300	12 3215	2163	.638 8997	11 3292	1960	.277 0696	4 9127	853
	6	.710 1515	12 1015	2200	.627 5705	11 5219	1927	.272 1569	4 9963	836
	7	.722 2530	11 8782	2233	.616 0486	11 7105	1886	.267 1606	5 0782	819
	8	.734 1312	11 6516	2266	.604 3381	11 8955	1850	.262 0824	5 1587	805
	9	+0.745 7828	+11 4222	-2294	-0.592 4426	+12 0767	+1812	-0.256 9237	+5 2373	+ 786
	10	.757 2050	11 1891	2331	.580 3659	12 2540	1773	.251 6864	5 3144	771
	11	.768 3941	10 9535	2356	.568 1119	12 4278	1738	.246 3720	5 3898	754
	12	.779 3476	10 7146	2389	.555 6841	12 5977	1699	.240 9822	5 4637	739
	13	.790 0622	10 4731	2415	.543 0864	12 7637	1660	.235 5185	5 5357	720
	14	+0.800 5353	+10 2284	-2447	-0.530 3227	+12 9264	+1627	-0.229 9828	+5 6064	+ 707
	15	+0.810 7637	-2472	-2472	-0.517 3963	+1586	+1586	-0.224 3764	+ 687	+ 687

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Date	X_{1950}			Y_{1950}			Z_{1950}		
Feb. 15	+0.810	7637	-2472	-0.517	3963	+1586	-0.224	3764	+ 687
16	.820	7449	2505	.504	3113	1549	.218	7013	+5 6751 672
17	.830	4756	2530	.491	0714	1513	.212	9590	5 7423 655
18	.839	9533	2563	.477	6802	1474	.207	1512	5 8078 638
19	.849	1747	2589	.464	1416	1434	.201	2796	5 8716 621
		8 9625			13 6820			5 9337	
20	+0.858	1372	-2618	-0.450	4596	+1393	-0.195	3459	+5 9939 + 602
21	.866	8379	2650	.436	6383	1354	.189	3520	6 0525 586
22	.875	2736	2675	.422	6816	1309	.183	2995	6 1090 565
23	.883	4418	2703	.408	5940	1264	.177	1905	6 1637 547
24	.891	3397	2731	.394	3800	1219	.171	0268	6 2164 527
		7 6248			14 3359				
25	+0.898	9645	-2754	-0.380	0441	+1174	-0.164	8104	+6 2672 + 508
26	.906	3139	2778	.365	5908	1121	.158	5432	6 3158 486
27	.913	3855	2799	.351	0254	1078	.152	2274	6 3625 467
28	.920	1772	2819	.336	3522	1025	.145	8649	6 4069 444
29	.926	6870	2837	.321	5765	975	.139	4580	6 4492 423
		6 2261			14 8732				
Mar. 1	+0.932	9131	-2849	-0.306	7033	+ 929	-0.133	0088	+6 4895 + 403
2	.938	8543	2867	.291	7372	877	.126	5193	6 5277 382
3	.944	5088	2879	.276	6834	831	.119	9916	6 5639 362
4	.949	8754	2889	.261	5465	780	.113	4277	6 5978 339
5	.954	9531	2900	.246	3316	735	.106	8299	6 6299 321
		4 7877			15 2884				
6	+0.959	7408	-2909	-0.231	0432	+ 684	-0.100	2000	+6 6595 + 296
7	.964	2376	2918	.215	6864	640	.093	5405	6 6876 281
8	.968	4426	2925	.200	2656	591	.086	8529	6 7133 257
9	.972	3551	2933	.184	7857	546	.080	1396	6 7372 239
10	.975	9743	2938	.169	2512	501	.073	4024	6 7589 217
		3 3254			15 5846				
11	+0.979	2997	-2941	-0.153	6666	+ 451	-0.066	6435	+6 7786 + 197
12	.982	3310	2947	.138	0369	411	.059	8649	6 7966 180
13	.985	0676	2951	.122	3661	367	.053	0683	6 8124 158
14	.987	5091	2955	.106	6586	320	.046	2559	6 8262 138
15	.989	6551	2960	.090	9191	278	.039	4297	6 8384 122
		1 8500			15 7673				
16	+0.991	5051	-2965	-0.075	1518	+ 235	-0.032	5913	+6 8483 + 99
17	.993	0586	2968	.059	3610	189	.025	7430	6 8564 81
18	.994	3153	2973	.043	5513	145	.018	8866	6 8626 62
19	.995	2747	2980	.027	7271	100	.012	0240	6 8668 42
20	.995	9361	2979	.011	8929	51	.005	1572	6 8687 19
		3635			15 8393				
21	+0.996	2996	-2984	+0.003	9464	+ 4	+0.001	7115	+6 8688 + 1
22	.996	3647	2985	.019	7861	42	.008	5803	6 8667 21
23	.996	1313	2987	.035	6216	94	.015	4470	6 8626 41
24	.995	5992	2984	.051	4477	145	.022	3096	6 8563 63
25	.994	7687	2982	.067	2593	192	.029	1659	6 8479 84
		1 1287			15 7924				
26	+0.993	6400	-2976	+0.083	0517	+ 243	+0.036	0138	+6 8371 - 108
27	.992	2137	2970	.098	8198	297	.042	8509	6 8245 126
28	.990	4904	2962	.114	5582	344	.049	6754	6 8095 150
29	.988	4709	2952	.130	2622	394	.056	4849	6 7926 169
30	.986	1562	2937	.145	9268	444	.063	2775	6 7734 192
		2 6084			15 6202				
31	+0.983	5478	-2928	+0.161	5470	+ 492	+0.070	0509	+6 7522 - 212
Apr. 1	+0.980	6466	-2913	+0.177	1180	+ 535	+0.076	8031	+6 7322 - 230

Date	X_{1950}			Y_{1950}			Z_{1950}		
Apr. 1	+0.980 6466	- 3 1925	-2913	+0.177 1180	+15 5175	- 535	+0.076 8031	+6 7292	- 230
2	.977 4541	3 4821	2896	.192 6355	15 4589	586	.083 5323	6 7039	253
3	.973 9720	3 7704	2883	.208 0944	15 3961	628	.090 2362	6 6768	271
4	.970 2016	4 0570	2866	.223 4905	15 3284	677	.096 9130	6 6476	292
5	.966 1446	4 3417	2847	.238 8189	15 2567	717	.103 5606	6 6166	310
6	+0.961 8029	- 4 6248	-2831	+0.254 0756	+15 1804	- 763	+0.110 1772	+6 5837	- 329
7	.957 1781	4 9060	2812	.269 2560	15 1000	804	.116 7609	6 5489	348
8	.952 2721	5 1850	2790	.284 3560	15 0155	845	.123 3098	6 5124	365
9	.947 0871	5 4622	2772	.299 3715	14 9270	885	.129 8222	6 4738	386
10	.941 6249	5 7376	2754	.314 2985	14 8344	926	.136 2960	6 4339	399
11	+0.935 8873	- 6 0108	-2732	+0.329 1329	+14 7378	- 966	+0.142 7299	+6 3918	- 421
12	.929 8765	6 2823	2715	.343 8707	14 6378	1000	.149 1217	6 3485	433
13	.923 5942	6 5519	2696	.358 5085	14 5336	1042	.155 4702	6 3030	455
14	.917 0423	6 8196	2677	.373 0421	14 4257	1079	.161 7732	6 2562	468
15	.910 2227	7 0856	2660	.387 4678	14 3137	1120	.168 0294	6 2075	487
16	+0.903 1371	- 7 3495	-2639	+0.401 7815	+14 1977	-1160	+0.174 2369	+6 1569	- 506
17	.895 7876	7 6117	2622	.415 9792	14 0781	1196	.180 3938	6 1048	521
18	.888 1759	7 8717	2600	.430 0573	13 9538	1243	.186 4986	6 0509	539
19	.880 3042	8 1297	2580	.444 0111	13 8258	1280	.192 5495	5 9952	557
20	.872 1745	8 3853	2556	.457 8369	13 6931	1327	.198 5447	5 9375	577
21	+0.863 7892	- 8 6385	-2532	+0.471 5300	+13 5565	-1366	+0.204 4822	+5 8783	- 592
22	.855 1507	8 8891	2506	.485 0865	13 4157	1408	.210 3605	5 8171	612
23	.846 2616	9 1367	2476	.498 5022	13 2708	1449	.216 1776	5 7544	627
24	.837 1249	9 3818	2451	.511 7730	13 1216	1492	.221 9320	5 6896	648
25	.827 7431	9 6238	2420	.524 8946	12 9686	1530	.227 6216	5 6235	661
26	+0.818 1193	- 9 8623	-2385	+0.537 8632	+12 8114	-1572	+0.233 2451	+5 5553	- 682
27	.808 2570	10 0978	2355	.550 6746	12 6509	1605	.238 8004	5 4859	694
28	.798 1592	10 3298	2320	.563 3255	12 4864	1645	.244 2863	5 4146	713
29	.787 8294	10 5581	2283	.575 8119	12 3181	1683	.249 7009	5 3419	727
30	.777 2713	10 7834	2253	.588 1300	12 1467	1714	.255 0428	5 2677	742
May 1	+0.766 4879	-11 0046	-2212	+0.600 2767	+11 9719	-1748	+0.260 3105	+5 1919	- 758
2	.755 4833	11 2225	2179	.612 2486	11 7934	1785	.265 5024	5 1148	771
3	.744 2608	11 4367	2142	.624 0420	11 6123	1811	.270 6172	5 0363	785
4	.732 8241	11 6470	2103	.635 6543	11 4277	1846	.275 6535	4 9563	800
5	.721 1771	11 8536	2066	.647 0820	11 2403	1874	.280 6098	4 8751	812
6	+0.709 3235	-12 0565	-2029	+0.658 3223	+11 0500	-1903	+0.285 4849	+4 7928	- 823
7	.697 2670	12 2557	1992	.669 3723	10 8571	1929	.290 2777	4 7090	838
8	.685 0113	12 4509	1952	.680 2294	10 6616	1955	.294 9867	4 6242	848
9	.672 5604	12 6425	1916	.690 8910	10 4634	1982	.299 6109	4 5381	861
10	.659 9179	12 8306	1881	.701 3544	10 2630	2004	.304 1490	4 4512	869
11	+0.647 0873	-13 0152	-1846	+0.711 6174	+10 0600	-2030	+0.308 6002	+4 3630	- 882
12	.634 0721	13 1962	1810	.721 6774	9 8544	2056	.312 9632	4 2737	893
13	.620 8759	13 3739	1777	.731 5318	9 6465	2079	.317 2369	4 1832	905
14	.607 5020	13 5480	1741	.741 1783	9 4358	2107	.321 4201	4 0919	913
15	.593 9540	13 7185	1705	.750 6141	9 2227	2131	.325 5120	3 9991	928
16	+0.580 2355	-13 8855	-1670	+0.759 8368	+ 9 0065	-2162	+0.329 5111	+3 9053	- 938
17	+0.566 3500	-1632	-1632	+0.768 8433	-2187	-2187	+0.333 4164	- 949	- 949

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950.0

Date	X_{1950}			Y_{1950}			Z_{1950}		
May 17	+0.566 3500	-14 0487	-1632	+0.768 8433	+ 8 7878	-2187	+0.333 4164	+3 8104	- 949
18	.552 3013	14 2079	1592	.777 6311	8 5667	2211	.337 2268	3 7144	960
19	.538 0934	14 3631	1552	.786 1978	8 3424	2243	.340 9412	3 6171	973
20	.523 7303	14 5144	1513	.794 5402	8 1158	2266	.344 5583	3 5188	983
21	.509 2159	14 6614	1470	.802 6560	7 8867	2291	.348 0771	3 4196	992
22	+0.494 5545	-14 8035	-1421	+0.810 5427	+ 7 6549	-2318	+0.351 4967	+3 3191	-1005
23	.479 7510	14 9417	1382	.818 1976	7 4211	2338	.354 8158	3 2177	1014
24	.464 8093	15 0751	1334	.825 6187	7 1850	2361	.358 0335	3 1154	1023
25	.449 7342	15 2038	1287	.832 8037	6 9466	2384	.361 1489	3 0124	1030
26	.434 5304	15 3280	1242	.839 7503	6 7063	2403	.364 1613	2 9082	1042
27	+0.419 2024	-15 4474	-1194	+0.846 4566	+ 6 4644	-2419	+0.367 0695	+2 8034	-1048
28	.403 7550	15 5621	1147	.852 9210	6 2207	2437	.369 8729	2 6979	1055
29	.388 1929	15 6719	1098	.859 1417	5 9751	2456	.372 5708	2 5916	1063
30	.372 5210	15 7771	1052	.865 1168	5 7284	2467	.375 1624	2 4847	1069
31	.356 7439	15 8774	1003	.870 8452	5 4801	2483	.377 6471	2 3771	1076
June 1	+0.340 8665	-15 9729	- 955	+0.876 3253	+ 5 2305	-2496	+0.380 0242	+2 2689	-1082
2	.324 8936	16 0635	906	.881 5558	4 9800	2505	.382 2931	2 1604	1085
3	.308 8301	16 1496	861	.886 5358	4 7284	2516	.384 4535	2 0512	1092
4	.292 6805	16 2308	812	.891 2642	4 4759	2525	.386 5047	1 9417	1095
5	.276 4497	16 3074	766	.895 7401	4 2224	2535	.388 4464	1 8317	1100
6	+0.260 1423	-16 3795	- 721	+0.899 9625	+ 3 9685	-2539	+0.390 2781	+1 7216	-1101
7	.243 7628	16 4471	676	.903 9310	3 7138	2547	.391 9997	1 6109	1107
8	.227 3157	16 5102	631	.907 6448	3 4586	2552	.393 6106	1 5000	1109
9	.210 8055	16 5694	592	.911 1034	3 2026	2560	.395 1106	1 3890	1110
10	.194 2361	16 6243	549	.914 3060	2 9458	2568	.396 4996	1 2773	1117
11	+0.177 6118	-16 6746	- 593	+0.917 2518	+ 2 6884	-2574	+0.397 7769	+1 1656	-1117
12	.160 9372	16 7209	463	.919 9402	2 4300	2584	.398 9425	1 0535	1121
13	.144 2163	16 7629	420	.922 3702	2 1710	2590	.399 9960	9408	1127
14	.127 4534	16 8002	373	.924 5412	1 9108	2602	.400 9368	8280	1128
15	.110 6532	16 8332	330	.926 4520	1 6500	2608	.401 7648	7149	1131
16	+0.093 8200	-16 8612	- 280	+0.928 1020	+ 1 3883	-2617	+0.402 4797	+ 6014	-1135
17	.076 9588	16 8846	234	.929 4903	1 1259	2624	.403 0811	4877	1137
18	.060 0742	16 9031	185	.930 6162	8630	2629	.403 5688	3737	1140
19	.043 1711	16 9165	134	.931 4792	5995	2635	.403 9425	2595	1142
20	.026 2546	16 9251	86	.932 0787	3357	2638	.404 2020	1453	1142
21	+0.009 3295	-16 9286	- 35	+0.932 4144	+ 719	-2638	+0.404 3473	+ 310	-1143
22	-.007 5991	16 9269	+ 17	.932 4863	1922	2641	.404 3783	833	1143
23	.024 5260	16 9203	66	.932 2941	4562	2640	.404 2950	1978	1145
24	.041 4463	16 9086	117	.931 8379	7202	2640	.404 0972	3121	1143
25	.058 3549	16 8919	167	.931 1177	9838	2636	.403 7851	4263	1142
26	-0.075 2468	-16 8702	+ 217	+0.930 1339	+ 1 2471	-2633	+0.403 3588	+ 5403	-1140
27	.092 1170	16 8433	269	.928 8868	1 5097	2626	.402 8185	6541	1138
28	.108 9603	16 8115	318	.927 3771	1 7717	2620	.402 1644	7676	1135
29	.125 7718	16 7747	368	.925 6054	2 0330	2613	.401 3968	8810	1134
30	.142 5465	16 7332	415	.923 5724	2 2936	2606	.400 5158	9939	1129
July 1	-0.159 2797	-16 6866	+ 466	+0.921 2788	+ 2 5531	-2595	+0.399 5219	+1 1064	-1125
2	-0.175 9663	+ 511	+ 511	+0.918 7257	-2584	-2584	+0.398 4155	-1123	-1123

FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950.0

Date		X_{1950}		Y_{1950}		Z_{1950}	
July	1	-0.159 2797	-16 6866 + 466	+0.921 2788	-2595	+0.399 5219	-1125
	2	.175 9663	16 6355 511	.918 7257	2 5531 2584	.398 4155	1123
	3	.192 6018	16 5797 558	.915 9142	3 0688 2573	.397 1968	1115
	4	.209 1815	16 5194 603	.912 8454	3 3246 2558	.395 8666	1112
	5	.225 7009	16 4547 647	.909 5208	3 5794 2548	.394 4252	1106
	6	-0.242 1556	-16 3857 + 690	+0.905 9414	-2536	+0.392 8732	-1100
	7	.258 5413	16 3125 732	.902 1084	3 8330 2523	.391 2112	1098
	8	.274 8538	16 2353 772	.898 0231	4 0853 2509	.389 4394	1088
	9	.291 0891	16 1539 814	.893 6869	4 3362 2499	.387 5588	1087
	10	.307 2430	16 0685 854	.889 1008	4 5861 2492	.385 5695	1081
	11	-0.323 3115	-15 9787 + 898	+0.884 2655	-2477	+0.383 4721	-1076
	12	.339 2902	15 8848 939	.879 1825	5 0830 2470	.381 2671	1070
	13	.355 1750	15 7865 983	.873 8525	5 3300 2456	.378 9551	1066
	14	.370 9615	15 6835 1030	.868 2769	5 5756 2447	.376 5365	1061
	15	.386 6450	15 5763 1072	.862 4566	5 8203 2434	.374 0118	1054
	16	-0.402 2213	-15 4646 + 1117	+0.856 3929	-2421	+0.371 3817	-1049
	17	.417 6859	15 3477 1169	.850 0871	6 3058 2406	.368 6467	1042
	18	.433 0336	15 2266 1211	.843 5407	6 5464 2389	.365 8075	1035
	19	.448 2602	15 1010 1256	.836 7554	6 7853 2371	.362 8648	1028
	20	.463 3612	14 9707 1303	.829 7330	7 0224 2354	.359 8193	1018
	21	-0.478 3319	-14 8357 + 1350	+0.822 4752	-2334	+0.356 6720	-1010
	22	.493 1676	14 6964 1393	.814 9840	7 4912 2312	.353 4237	1003
	23	.507 8640	14 5525 1439	.807 2616	7 7224 2293	.350 0751	992
	24	.522 4165	14 4044 1481	.799 3099	7 9517 2265	.346 6273	983
	25	.536 8209	14 2515 1529	.791 1317	8 1782 2244	.343 0812	970
	26	-0.551 0724	-14 0947 + 1568	+0.782 7291	-2220	+0.339 4381	-963
	27	.565 1671	13 9336 1611	.774 1045	8 6246 2191	.335 6987	950
	28	.579 1007	13 7684 1652	.765 2608	8 8437 2166	.331 8643	940
	29	.592 8691	13 5992 1692	.756 2005	9 0603 2133	.327 9359	925
	30	.606 4683	13 4260 1732	.746 9269	9 2736 2110	.323 9150	917
Aug.	31	-0.619 8943	-13 2493 + 1767	+0.737 4423	-2078	+0.319 8024	-901
	1	.633 1436	13 0687 1806	.727 7499	9 6924 2046	.315 5997	889
	2	.646 2123	12 8851 1836	.717 8529	9 8970 2019	.311 3081	877
	3	.659 0974	12 6976 1875	.707 7540	10 0989 1988	.306 9288	866
	4	.671 7950	12 5072 1904	.697 4563	10 2977 1959	.302 4629	850
	5	-0.684 3022	-12 3138 + 1934	+0.686 9627	-1933	+0.297 9120	-839
	6	.696 6160	12 1169 1969	.676 2758	10 6869 1900	.293 2772	826
	7	.708 7329	11 9171 1998	.665 3989	10 8769 1875	.288 5598	815
	8	.720 6500	11 7140 2031	.654 3345	11 0644 1849	.283 7609	801
	9	.732 3640	11 5076 2064	.643 0852	11 2493 1821	.278 8819	790
	10	-0.743 8716	-11 2982 + 2094	+0.631 6538	-1794	+0.273 9239	-778
	11	.755 1698	11 0849 2133	.620 0430	11 6108 1766	.268 8881	766
	12	.766 2547	10 8686 2163	.608 2556	11 7874 1736	.263 7757	751
	13	.777 1233	10 6488 2198	.596 2946	11 9610 1705	.258 5882	738
	14	.787 7721	10 4254 2234	.584 1631	12 1315 1676	.253 3269	726
	15	-0.798 1975	-10 1989 + 2265	+0.571 8640	-1641	+0.247 9930	-710
	16	-0.808 3964	-10 0001 + 2301	+0.559 4008	-1609	+0.242 5881	-696

FOR 0^h EPHEMERIS TIME

MEAN EQUATOR AND EQUINOX OF 1950.0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Aug. 16	-0.808 3964	- 9 9688	+2301	+0.559 4008	-12 6241	-1609	+0.242 5881	-5 4745	- 696
17	.818 3652	9 7354	2334	.546 7767	12 7814	1573	.237 1136	5 5425	680
18	.828 1006	9 4991	2363	.533 9953	12 9350	1536	.231 5711	5 6092	667
19	.837 5997	9 2595	2396	.521 0603	13 0853	1503	.225 9619	5 6741	649
20	.846 8592	9 0168	2427	.507 9750	13 2316	1463	.220 2878	5 7373	632
21	-0.855 8760	- 8 7712	+2456	+0.494 7434	-13 3739	-1423	+0.214 5505	-5 7992	- 619
22	.864 6472	8 5226	2486	.481 3695	13 5125	1386	.208 7513	5 8591	599
23	.873 1698	8 2714	2512	.467 8570	13 6470	1345	.202 8922	5 9173	582
24	.881 4412	8 0173	2541	.454 2100	13 7773	1303	.196 9749	5 9740	567
25	.889 4585	7 7607	2566	.440 4327	13 9034	1261	.191 0009	6 0287	547
26	-0.897 2192	- 7 5020	+2587	+0.426 5293	-14 0254	-1220	+0.184 9722	-6 0816	- 529
27	.904 7212	7 2408	2612	.412 5039	14 1431	1177	.178 8906	6 1328	512
28	.911 9620	6 9778	2630	.398 3608	14 2561	1130	.172 7578	6 1820	492
29	.918 9398	6 7127	2651	.384 1047	14 3653	1092	.166 5758	6 2295	475
30	.925 6525	6 4459	2668	.369 7394	14 4701	1048	.160 3463	6 2751	456
31	-0.932 0984	- 6 1776	+2683	+0.355 2693	-14 5707	-1006	+0.154 0712	-6 3189	- 438
Sept. 1	.938 2760	5 9074	2702	.340 6986	14 6670	963	.147 7523	6 3609	420
2	.944 1834	5 6359	2715	.326 0316	14 7593	923	.141 3914	6 4011	402
3	.949 8193	5 3632	2727	.311 2723	14 8479	886	.134 9903	6 4394	383
4	.955 1825	5 0889	2743	.296 4244	14 9323	844	.128 5509	6 4762	368
5	-0.960 2714	- 4 8134	+2755	+0.281 4921	-15 0128	- 805	+0.122 0747	-6 5112	- 350
6	.965 0848	4 5359	2775	.266 4793	15 0897	769	.115 5635	6 5445	333
7	.969 6207	4 2573	2786	.251 3896	15 1624	727	.109 0190	6 5760	315
8	.973 8780	3 9770	2803	.236 2272	15 2314	690	.102 4430	6 6059	299
9	.977 8550	3 6951	2819	.220 9958	15 2962	648	.095 8371	6 6337	278
10	-0.981 5501	- 3 4117	+2834	+0.205 6996	-15 3568	- 606	+0.089 2034	-6 6600	- 263
11	.984 9618	3 1267	2850	.190 3428	15 4134	566	.082 5434	6 6844	244
12	.988 0885	2 8402	2865	.174 9294	15 4656	522	.075 8590	6 7067	223
13	.990 9287	2 5527	2875	.159 4638	15 5133	477	.069 1523	6 7275	208
14	.993 4814	2 2635	2892	.143 9505	15 5565	432	.062 4248	6 7459	184
15	-0.995 7449	- 1 9733	+2902	+0.128 3940	-15 5952	- 387	+0.055 6789	-6 7627	- 168
16	.997 7182	1 6821	2912	.112 7988	15 6294	342	.048 9162	6 7773	146
17	.999 4003	1 3899	2922	.097 1694	15 6589	295	.042 1389	6 7900	127
18	1.000 7902	1 0966	2933	.081 5105	15 6836	247	.035 3489	6 8007	107
19	1.001 8868	8028	2938	.065 8269	15 7033	197	.028 5482	6 8091	84
20	-1.002 6896	- 5083	+2945	+0.050 1236	-15 7185	- 152	+0.021 7391	-6 8158	- 67
21	1.003 1979	2133	2950	.034 4051	15 7285	100	.014 9233	6 8202	44
22	1.003 4112	821	2954	.018 6766	15 7336	51	.008 1031	6 8224	22
23	1.003 3291	3777	2956	+ .002 9430	15 7339	- 3	+ .001 2807	6 8226	- 2
24	1.002 9514	6729	2952	- .012 7909	15 7291	+ 48	- .005 5419	6 8207	+ 19
25	-1.002 2785	- 9683	+2954	-0.028 5200	-15 7194	+ 97	-0.012 3626	-6 8166	+ 41
26	1.001 3102	1 2630	2947	.044 2394	15 7049	145	.019 1792	6 8105	61
27	1.000 0472	1 5574	2944	.059 9443	15 6855	194	.025 9897	6 8024	81
28	.998 4898	1 8509	2935	.075 6298	15 6617	238	.032 7921	6 7922	102
29	.996 6389	2 1439	2930	.091 2915	15 6333	284	.039 5843	6 7800	122
30	-0.994 4950	- 2 4361	+2922	-0.106 9248	-15 6002	+ 331	-0.046 3643	-6 7658	+ 142
Oct. 1	-0.992 0589	+ 2914	+2914	-0.122 5250	+ 371	+ 371	-0.053 1301	+ 161	+ 161

SUN, 1960
FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950-0

Date		X_{1950}			Y_{1950}			Z_{1950}		
Oct.	1	-0.992 0589	+ 2 7275	+2914	-0.122 5250	-15 5631	+ 371	-0.053 1301	-6 7497	+ 161
	2	.989 3314	3 0182	2907	.138 0881	15 5214	417	.059 8798	6 7317	180
	3	.986 3132	3 3079	2897	.153 6095	15 4756	458	.066 6115	6 7119	198
	4	.983 0053	3 5971	2892	.169 0851	15 4255	501	.073 3234	6 6901	218
	5	.979 4082	3 8853	2882	.184 5106	15 3712	543	.080 0135	6 6665	236
	6	-0.975 5229	+ 4 1727	+2874	-0.199 8818	-15 3128	+ 584	-0.086 6800	-6 6410	+ 255
	7	.971 3502	4 4597	2870	.215 1946	15 2499	629	.093 3210	6 6137	273
	8	.966 8905	4 7454	2857	.230 4445	15 1827	672	.099 9347	6 5843	294
	9	.962 1451	5 0308	2854	.245 6272	15 1112	715	.106 5190	6 5532	311
	10	.957 1143	5 3150	2842	.260 7384	15 0349	763	.113 0722	6 5199	333
	11	-0.951 7993	+ 5 5982	+2832	-0.275 7733	-14 9544	+ 805	-0.119 5921	-6 4850	+ 349
	12	.946 2011	5 8803	2821	.290 7277	14 8693	851	.126 0771	6 4478	372
	13	.940 3208	6 1612	2809	.305 5970	14 7792	901	.132 5249	6 4088	390
	14	.934 1596	6 4406	2794	.320 3762	14 6849	943	.138 9337	6 3678	410
	15	.927 7190	6 7187	2781	.335 0611	14 5858	991	.145 3015	6 3246	432
	16	-0.921 0003	+ 6 9953	+2766	-0.349 6469	-14 4823	+1035	-0.151 6261	-6 2797	+ 449
	17	.914 0050	7 2700	2747	.364 1292	14 3738	1085	.157 9058	6 2325	472
	18	.906 7350	7 5432	2732	.378 5030	14 2606	1132	.164 1383	6 1837	488
	19	.899 1918	7 8141	2709	.392 7636	14 1427	1179	.170 3220	6 1325	512
	20	.891 3777	8 0829	2688	.406 9063	14 0202	1225	.176 4545	6 0795	530
	21	-0.883 2948	+ 8 3494	+2665	-0.420 9265	-13 8930	+1272	-0.182 5340	-6 0244	+ 551
	22	.874 9454	8 6135	2641	.434 8195	13 7611	1319	.188 5584	5 9675	569
	23	.866 3319	8 8746	2611	.448 5806	13 6248	1363	.194 5259	5 9084	591
	24	.857 4573	9 1331	2585	.462 2054	13 4840	1408	.200 4343	5 8476	608
	25	.848 3242	9 3882	2551	.475 6894	13 3393	1447	.206 2819	5 7850	626
	26	-0.838 9360	+ 9 6407	+2525	-0.489 0287	-13 1902	+1491	-0.212 0669	-5 7205	+ 645
	27	.829 2953	9 8901	2494	.502 2189	13 0373	1529	.217 7874	5 6543	662
	28	.819 4052	10 1361	2460	.515 2562	12 8805	1568	.223 4417	5 5864	679
	29	.809 2691	10 3792	2431	.528 1367	12 7200	1605	.229 0281	5 5170	694
	30	.798 8899	10 6191	2399	.540 8567	12 5561	1639	.234 5451	5 4458	712
	31	-0.788 2708	+10 8559	+2368	-0.553 4128	-12 3883	+1678	-0.239 9909	-5 3730	+ 728
Nov.	1	.777 4149	11 0898	2339	.565 8011	12 2174	1709	.245 3639	5 2988	742
	2	.766 3251	11 3204	2306	.578 0185	12 0429	1745	.250 6627	5 2230	758
	3	.755 0047	11 5481	2277	.590 0614	11 8647	1782	.255 8857	5 1456	774
	4	.743 4566	11 7726	2245	.601 9261	11 6830	1817	.261 0313	5 0667	789
	5	-0.731 6840	+11 9942	+2216	-0.613 6091	-11 4981	+1849	-0.266 0980	-4 9864	+ 803
	6	.719 6898	12 2124	2182	.625 1072	11 3093	1888	.271 0844	4 9044	820
	7	.707 4774	12 4276	2152	.636 4165	11 1172	1921	.275 9888	4 8210	834
	8	.695 0498	12 6393	2117	.647 5337	10 9215	1957	.280 8098	4 7359	851
	9	.682 4105	12 8477	2084	.658 4552	10 7222	1993	.285 5457	4 6494	865
	10	-0.669 5628	+13 0525	+2048	-0.669 1774	-10 5194	+2028	-0.290 1951	-4 5614	+ 880
	11	.656 5103	13 2540	2015	.679 6968	10 3130	2064	.294 7565	4 4718	896
	12	.643 2563	13 4514	1974	.690 0098	10 1034	2096	.299 2283	4 3807	911
	13	.629 8049	13 6451	1937	.700 1132	9 8900	2134	.303 6090	4 2882	925
	14	.616 1598	13 8351	1900	.710 0032	9 6731	2169	.307 8972	4 1942	940
	15	-0.602 3247	+14 0210	+1859	-0.719 6763	-9 4531	+2200	-0.312 0914	-4 0990	+ 952
	16	-0.588 3037	+14 2117	+1817	-0.729 1294	-9 2335	+2235	-0.316 1904	-4 0190	+ 971

FOR 0^h EPHEMERIS TIME

MEAN EQUATOR AND EQUINOX OF 1950.0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Nov. 16	-0.588	3037	+1817	-0.729	1294	+2235	-0.316	1904	+971
17	.574	1010	14 2027	.738	3590	9 2296	.320	1923	-4 0019
18	.559	7210	14 3800	.747	3614	9 0024	.324	0960	3 9037
19	.545	1681	14 5529	.756	1337	8 7723	.327	8999	3 8039
20	.530	4472	14 7209	.764	6727	8 5390	.331	6030	3 7031
			14 8843			8 3027			3 6006
21	-0.515	5629	+1587	-0.772	9754	+2389	-0.335	2036	+1033
22	.500	5199	+15 0430	.781	0392	8 0638	.338	7009	-3 4973
23	.485	3236	15 1963	.788	8611	7 8219	.342	0933	3 3924
24	.469	9788	15 3448	.796	4391	7 5780	.345	3802	3 2869
25	.454	4907	15 4881	.803	7708	7 3317	.348	5603	3 1801
			15 6266			7 0831			3 0724
26	-0.438	8641	+1536	-0.810	8539	+2500	-0.351	6327	+1084
27	.423	1039	+15 7602	.817	6870	6 8331	.354	5967	-2 9640
28	.407	2149	15 8890	.824	2677	6 5807	.357	4512	2 8545
29	.391	2022	16 0127	.830	5946	6 3269	.360	1955	2 7443
30	.375	0703	16 1319	.836	6657	6 0711	.362	8289	2 6334
			16 2463			5 8137			2 5215
Dec. 1	-0.358	8240	+1096	-0.842	4794	+2590	-0.365	3504	+1123
2	.342	4681	+16 3559	.848	0341	5 5547	.367	7596	-2 4092
3	.326	0073	16 4608	.853	3280	5 2939	.370	0555	2 2959
4	.309	4462	16 5611	.858	3594	5 0314	.372	2375	2 1820
5	.292	7897	16 6565	.863	1269	4 7675	.374	3049	2 0674
			16 7472			4 5019			1 9519
6	-0.276	0425	+858	-0.867	6288	+2673	-0.376	2568	+1158
7	.259	2095	+16 8330	.871	8634	4 2346	.378	0929	-1 8361
8	.242	2955	16 9140	.875	8294	3 9660	.379	8123	1 7194
9	.225	3057	16 9898	.879	5254	3 6960	.381	4145	1 6022
10	.208	2449	17 0608	.882	9496	3 4242	.382	8989	1 4844
			17 1267			3 1513			1 3660
11	-0.191	1182	+608	-0.886	1009	+2745	-0.384	2649	+1190
12	.173	9307	+17 1875	.888	9777	2 8768	.385	5119	-1 2470
13	.156	6878	17 2429	.891	5790	2 6013	.386	6395	1 1276
14	.139	3947	17 2931	.893	9033	2 3243	.387	6469	1 0074
15	.122	0566	17 3381	.895	9497	2 0464	.388	5340	8871
			17 3772			1 7673			7661
16	-0.104	6794	+338	-0.897	7170	+2801	-0.389	3001	+1211
17	.087	2684	+17 4110	.899	2042	1 4872	.389	9451	-6450
18	.069	8297	17 4387	.900	4104	1 2062	.390	4684	5233
19	.052	3689	17 4608	.901	3352	9248	.390	8697	4013
20	.034	8920	17 4769	.901	9783	6431	.391	1489	2792
			17 4870			3611			1572
21	-0.017	4050	+47	-0.902	3394	+2821	-0.391	3061	+1222
22	+0.000	0867	+17 4917	.902	4184	790	.391	3411	-350
23	.017	5768	17 4901	.902	2158	2026	.391	2539	872
24	.035	0598	17 4830	.901	7319	4839	.391	0449	2090
25	.052	5303	17 4705	.900	9671	7648	.390	7139	3310
			17 4523			1 0450			4525
26	+0.069	9826	+232	-0.899	9221	+2795	-0.390	2614	+1213
27	.087	4117	+17 4291	.898	5976	1 3245	.389	6876	+5738
28	.104	8121	17 4004	.896	9941	1 6035	.388	9927	6949
29	.122	1787	17 3666	.895	1125	1 8816	.388	1770	8157
30	.139	5064	17 3277	.892	9534	2 1591	.387	2409	9361
			17 2836			2 4357			1 0563
31	+0.156	7900	+493	-0.890	5177	+2758	-0.386	1846	+1197
32	+0.174	0243	+17 2343	-0.887	8062	+2750	-0.385	0086	+1194

MEAN LONGITUDE AND ANOMALY; PRECESSIONAL CONSTANTS

Date	Mean Longitude	Mean Anomaly	Epoch 1960.0	
			Mean obliquity ϵ	$23^{\circ} 26' 40''.15$ $23^{\circ}.44449$
Jan. -3	$275^{\circ}.7227$	$353^{\circ}.4704$		
7	$285^{\circ}.5792$	$3^{\circ}.3264$	$\sin \epsilon$	$0.397\ 86035$
17	$295^{\circ}.4357$	$13^{\circ}.1824$	$\cos \epsilon$	$0.917\ 44599$
27	$305^{\circ}.2921$	$23^{\circ}.0384$	$\tan \epsilon$	$0.433\ 66079$
Feb. 6	$315^{\circ}.1486$	$32^{\circ}.8944$	$\operatorname{cosec} \epsilon$	$2.513\ 4447$
16	$325^{\circ}.0051$	$42^{\circ}.7504$	$\sec \epsilon$	$1.089\ 9824$
26	$334^{\circ}.8616$	$52^{\circ}.6064$	$\cot \epsilon$	$2.305\ 9498$
Mar. 7	$344^{\circ}.7181$	$62^{\circ}.4624$	General precession p	$50''.2697$ $= 0^{\circ}.013\ 9638$
17	$354^{\circ}.5745$	$72^{\circ}.3184$	Precession in R.A. m	$3^{\circ}.07346$
27	$4^{\circ}.4310$	$82^{\circ}.1744$	Precession in Dec. n	$1^{\circ}.33612$ $= 20''.0417$
Apr. 6	$14^{\circ}.2875$	$92^{\circ}.0304$		
16	$24^{\circ}.1439$	$101^{\circ}.8865$	Ascending node of moving ecliptic on fixed ecliptic Π	$174^{\circ}\ 29'.9$ $= 174^{\circ}.499$
26	$34^{\circ}.0004$	$111^{\circ}.7425$	Speed of rotation of ecliptic π	$0''.4707$ $= 0^{\circ}.000\ 1308$
May 6	$43^{\circ}.8569$	$121^{\circ}.5985$		
16	$53^{\circ}.7134$	$131^{\circ}.4545$		
26	$63^{\circ}.5698$	$141^{\circ}.3105$		
June 5	$73^{\circ}.4263$	$151^{\circ}.1665$		
15	$83^{\circ}.2828$	$161^{\circ}.0225$		
25	$93^{\circ}.1393$	$170^{\circ}.8785$		
July 5	$102^{\circ}.9957$	$180^{\circ}.7345$		
15	$112^{\circ}.8522$	$190^{\circ}.5905$	For reduction from	
25	$122^{\circ}.7087$	$200^{\circ}.4465$	1960.0 to 1950.0	1950.0 to 1960.0
Aug. 4	$132^{\circ}.5652$	$210^{\circ}.3025$	$\zeta_0 \dots$	$-3' 50''.51$ $= -15^{\circ}.367$
14	$142^{\circ}.4216$	$220^{\circ}.1585$	$z \dots$	$-3' 50''.51$ $= -15^{\circ}.367$
24	$152^{\circ}.2781$	$230^{\circ}.0145$		
Sept. 3	$162^{\circ}.1346$	$239^{\circ}.8705$	$\sin \theta$	$-0.000\ 97167$ $+0.000\ 97167$
13	$171^{\circ}.9910$	$249^{\circ}.7265$	$\tan \frac{1}{2} \theta$	$-0.000\ 48584$ $+0.000\ 48584$
23	$181^{\circ}.8475$	$259^{\circ}.5825$	M^s	$-30^{\circ}.734$ $+30^{\circ}.734$
Oct. 3	$191^{\circ}.7040$	$269^{\circ}.4385$	N^s	$-13^{\circ}.361$ $+13^{\circ}.361$
13	$201^{\circ}.5605$	$279^{\circ}.2945$	N''	$-200''.42$ $+200''.42$
23	$211^{\circ}.4169$	$289^{\circ}.1505$	$a \dots$	$-8' 22''.69$ $= -0^{\circ}.13964$
Nov. 2	$221^{\circ}.2734$	$299^{\circ}.0065$	$b \dots$	$-4''.71$ $= -0^{\circ}.001308$
12	$231^{\circ}.1299$	$308^{\circ}.8625$	$c \dots$	$+5^{\circ}\ 28'.6$ $= +5^{\circ}.477$
22	$240^{\circ}.9864$	$318^{\circ}.7185$		$+8' 22''.69$ $+0^{\circ}.13964$
Dec. 2	$250^{\circ}.8428$	$328^{\circ}.5745$		$+4''.71$ $+0^{\circ}.001308$
12	$260^{\circ}.6993$	$338^{\circ}.4305$		$+5^{\circ}\ 37'.0$ $+5^{\circ}.617$
22	$270^{\circ}.5558$	$348^{\circ}.2865$		
32	$280^{\circ}.4123$	$358^{\circ}.1425$		
Daily motion	$0^{\circ}.985647$	$0^{\circ}.985600$		
Epoch 1960 January 1.0				
Mean longitude of perigee	Γ	$282^{\circ}.25248$		
Eccentricity	e	0.0167259		
			Formulæ :	
			$a = a_0 + M + N \sin a_m \tan \delta_m$	
			$\delta = \delta_0 + N \cos a_m$	
			$\lambda = \lambda_0 + a - b \cos(\lambda_0 + c) \tan \beta_0$	
			$\beta = \beta_0 + b \sin(\lambda_0 + c)$	
			$\Omega = \Omega_0 + a - b \sin(\Omega_0 + c) \cot i_0$	
			$i = i_0 + b \cos(\Omega_0 + c)$	
			$\omega = \omega_0 + b \sin(\Omega_0 + c) \operatorname{cosec} i_0$	
			where a_m, δ_m are for the mean epoch.	

MEAN EQUATOR, ORBIT, LONGITUDE AND ELONGATION

Date	Mean Equator			Orbit		Mean Longitude	Mean Elongation
	i	Δ	Ω'	Γ'	Ω	ℓ	D
Jan. -3	24 [°] 977	358 [°] 999	-0 [°] 067	255 [°] 2449	178 [°] 9371	251 [°] 8699	336 [°] 1471
7	24 [°] 976	358 [°] 500	0 [°] 101	256 [°] 3590	178 [°] 4076	23 [°] 6338	98 [°] 0546
17	24 [°] 976	358 [°] 001	0 [°] 135	257 [°] 4730	177 [°] 8780	155 [°] 3978	219 [°] 9621
27	24 [°] 975	357 [°] 502	0 [°] 168	258 [°] 5871	177 [°] 3485	287 [°] 1617	341 [°] 8696
Feb. 6	24 [°] 975	357 [°] 003	0 [°] 202	259 [°] 7011	176 [°] 8190	58 [°] 9257	103 [°] 7771
16	24 [°] 974	356 [°] 504	-0 [°] 235	260 [°] 8151	176 [°] 2894	190 [°] 6897	225 [°] 6846
26	24 [°] 973	356 [°] 005	0 [°] 269	261 [°] 9292	175 [°] 7599	322 [°] 4536	347 [°] 5921
Mar. 7	24 [°] 972	355 [°] 506	0 [°] 302	263 [°] 0432	175 [°] 2303	94 [°] 2176	109 [°] 4996
17	24 [°] 971	355 [°] 007	0 [°] 336	264 [°] 1572	174 [°] 7008	225 [°] 9816	231 [°] 4071
27	24 [°] 970	354 [°] 508	0 [°] 369	265 [°] 2713	174 [°] 1713	357 [°] 7455	353 [°] 3145
Apr. 6	24 [°] 968	354 [°] 008	-0 [°] 403	266 [°] 3853	173 [°] 6417	129 [°] 5095	115 [°] 2220
16	24 [°] 967	353 [°] 509	0 [°] 436	267 [°] 4994	173 [°] 1122	261 [°] 2735	237 [°] 1295
26	24 [°] 965	353 [°] 010	0 [°] 470	268 [°] 6134	172 [°] 5826	33 [°] 0374	359 [°] 0370
May 6	24 [°] 963	352 [°] 511	0 [°] 503	269 [°] 7274	172 [°] 0531	164 [°] 8014	120 [°] 9445
16	24 [°] 961	352 [°] 012	0 [°] 536	270 [°] 8415	171 [°] 5236	296 [°] 5654	242 [°] 8520
26	24 [°] 959	351 [°] 512	-0 [°] 569	271 [°] 9555	170 [°] 9940	68 [°] 3293	4 [°] 7595
June 5	24 [°] 957	351 [°] 013	0 [°] 603	273 [°] 0695	170 [°] 4645	200 [°] 0933	126 [°] 6670
15	24 [°] 954	350 [°] 514	0 [°] 636	274 [°] 1836	169 [°] 9350	331 [°] 8573	248 [°] 5745
25	24 [°] 952	350 [°] 015	0 [°] 669	275 [°] 2976	169 [°] 4054	103 [°] 6212	10 [°] 4820
July 5	24 [°] 950	349 [°] 516	0 [°] 702	276 [°] 4116	168 [°] 8759	235 [°] 3852	132 [°] 3895
15	24 [°] 947	349 [°] 016	-0 [°] 735	277 [°] 5257	168 [°] 3463	7 [°] 1492	254 [°] 2969
25	24 [°] 944	348 [°] 517	0 [°] 768	278 [°] 6397	167 [°] 8168	138 [°] 9131	16 [°] 2044
Aug. 4	24 [°] 941	348 [°] 017	0 [°] 801	279 [°] 7538	167 [°] 2873	270 [°] 6771	138 [°] 1119
14	24 [°] 938	347 [°] 518	0 [°] 834	280 [°] 8678	166 [°] 7577	42 [°] 4410	260 [°] 0194
24	24 [°] 935	347 [°] 018	0 [°] 867	281 [°] 9818	166 [°] 2282	174 [°] 2050	21 [°] 9269
Sept. 3	24 [°] 932	346 [°] 518	-0 [°] 899	283 [°] 0959	165 [°] 6986	305 [°] 9690	143 [°] 8344
13	24 [°] 929	346 [°] 018	0 [°] 932	284 [°] 2099	165 [°] 1691	77 [°] 7329	265 [°] 7419
23	24 [°] 925	345 [°] 518	0 [°] 965	285 [°] 3239	164 [°] 6396	209 [°] 4969	27 [°] 6494
Oct. 3	24 [°] 922	345 [°] 018	0 [°] 997	286 [°] 4380	164 [°] 1100	341 [°] 2609	149 [°] 5569
13	24 [°] 918	344 [°] 518	1 [°] 030	287 [°] 5520	163 [°] 5805	113 [°] 0248	271 [°] 4644
23	24 [°] 914	344 [°] 018	-1 [°] 062	288 [°] 6661	163 [°] 0510	244 [°] 7888	33 [°] 3719
Nov. 2	24 [°] 910	343 [°] 518	1 [°] 095	289 [°] 7801	162 [°] 5214	16 [°] 5528	155 [°] 2794
12	24 [°] 906	343 [°] 018	1 [°] 127	290 [°] 8941	161 [°] 9919	148 [°] 3167	277 [°] 1868
22	24 [°] 902	342 [°] 518	1 [°] 159	292 [°] 0082	161 [°] 4623	280 [°] 0807	39 [°] 0943
Dec. 2	24 [°] 897	342 [°] 018	1 [°] 191	293 [°] 1222	160 [°] 9328	51 [°] 8447	161 [°] 0018
12	24 [°] 893	341 [°] 518	-1 [°] 223	294 [°] 2362	160 [°] 4033	183 [°] 6086	282 [°] 9093
22	24 [°] 888	341 [°] 017	1 [°] 255	295 [°] 3503	159 [°] 8737	315 [°] 3726	44 [°] 8168
32	24 [°] 884	340 [°] 517	-1 [°] 287	296 [°] 4643	159 [°] 3442	87 [°] 1366	166 [°] 7243
Daily motions				+0 [°] .111404	-0 [°] .052954	13 [°] .176396	12 [°] .190749

Epoch 1900.0

Eccentricity = 0.05490 0489

Inclination = 5[°].145 3964

MOON, 1960

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Jan. 0.0	295° 29' 51".37	+4° 27' 20".11	16' 32".09	60' 41".109	L 0 01.2459 ^h 12.4934 ^h
0.5	302 55 43.73	4 07 15.93	16 26.61	60 21.017	U 0 13.7393
1.0	310 15 34.06	3 43 19.64	16 20.24	59 57.645	L 1 02.2183
1.5	317 28 38.08	3 16 06.92	16 13.17	59 31.694	U 1 14.6820
2.0	324 34 25.90	2 46 15.19	16 05.60	59 03.895	L 2 03.1304
2.5	331 32 41.62	+2 14 21.88	15 57.72	58 34.973	U 2 15.5641
3.0	338 23 22.27	1 41 03.21	15 49.72	58 05.615	L 3 03.9842
3.5	345 06 36.23	1 06 53.17	15 41.78	57 36.448	U 3 16.3921
4.0	351 42 41.39	+0 32 22.98	15 34.03	57 08.023	L 4 04.7896
4.5	358 12 03.26	-0 01 59.17	15 26.62	56 40.809	U 4 17.1785
5.0	4 35 13.11	-0 35 48.16	15 19.64	56 15.192	L 5 05.5604
5.5	10 52 46.34	1 08 41.71	15 13.18	55 51.475	U 5 17.9372
6.0	17 05 20.92	1 40 20.17	15 07.29	55 29.885	L 6 06.3105
6.5	23 13 36.15	2 10 26.19	15 02.03	55 10.580	U 6 18.6818
7.0	29 18 11.58	2 38 44.32	14 57.42	54 53.654	L 7 07.0526
7.5	35 19 46.12	-3 05 00.78	14 53.47	54 39.152	U 7 19.4241
8.0	41 18 57.31	3 29 03.12	14 50.18	54 27.070	L 8 07.7973
8.5	47 16 20.79	3 50 40.08	14 47.54	54 17.368	U 8 20.1731
9.0	53 12 29.81	4 09 41.38	14 45.52	54 09.975	L 9 08.5522
9.5	59 07 54.95	4 25 57.66	14 44.11	54 04.794	U 9 20.9350
10.0	65 03 03.88	-4 39 20.49	14 43.27	54 01.710	L 10 09.3215
10.5	70 58 21.23	4 49 42.36	14 42.97	54 00.591	U 10 21.7117
11.0	76 54 08.54	4 56 56.80	14 43.16	54 01.300	L 11 10.1052
11.5	82 50 44.32	5 00 58.50	14 43.81	54 03.694	U 11 22.5016
12.0	88 48 24.22	5 01 43.47	14 44.88	54 07.628	L 12 10.9001
12.5	94 47 21.19	-4 59 09.22	14 46.34	54 12.963	U 12 23.2999
13.0	100 47 45.90	4 53 14.90	14 48.14	54 19.569	L 13 11.7002
13.5	106 49 47.02	4 44 01.54	14 50.25	54 27.326	... ..
14.0	112 53 31.74	4 31 32.14	14 52.65	54 36.128	U 14 00.1002
14.5	118 59 06.26	4 15 51.82	14 55.31	54 45.886	L 14 12.4991
15.0	125 06 36.33	-3 57 07.89	14 58.21	54 56.531	U 15 00.8963
15.5	131 16 07.77	3 35 29.88	15 01.33	55 08.012	L 15 13.2916
16.0	137 27 47.02	3 11 09.55	15 04.68	55 20.294	U 16 01.6848
16.5	143 41 41.57	2 44 20.83	15 08.24	55 33.360	L 16 14.0761
17.0	149 58 00.40	2 15 19.76	15 12.01	55 47.204	U 17 02.4658
17.5	156 16 54.21	-1 44 24.39	15 16.00	56 01.831	L 17 14.8546
18.0	162 38 35.61	1 11 54.69	15 20.20	56 17.245	U 18 03.2434
18.5	169 03 19.12	0 38 12.43	15 24.61	56 33.447	L 18 15.6332
19.0	175 31 20.96	-0 03 41.09	15 29.24	56 50.428	U 19 04.0254
19.5	182 02 58.73	+0 31 14.23	15 34.07	57 08.157	L 19 16.4213
20.0	188 38 30.86	+1 06 06.93	15 39.08	57 26.574	U 20 04.8224
20.5	195 18 15.79	1 40 28.99	15 44.26	57 45.582	L 20 17.2303
21.0	202 02 31.09	2 13 51.15	15 49.56	58 05.039	U 21 05.6466
21.5	208 51 32.23	2 45 43.07	15 54.93	58 24.748	L 21 18.0726
22.0	215 45 31.30	3 15 33.67	16 00.30	58 44.456	U 22 06.5098
22.5	222 44 35.53	+3 42 51.53	16 05.59	59 03.849	L 22 18.9589
23.0	229 48 45.84	+4 07 05.52	16 10.68	59 22.553	U 23 07.4205

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Jan. 23.0	229° 48' 45".84	+4° 07' 05".52	16' 10".68	59' 22".553	U 23 07.4205 ^{d h}
23.5	236 57 55.43	4 27 45.58	16 15.48	59 40.146 ^{+17.593}	L 23 19.8946 ^{12.4741}
24.0	244 11 48.53	4 44 23.66	16 19.84	59 56.162 ^{16.016}	U 24 08.3803 ^{.4857}
24.5	251 29 59.56	4 56 34.96	16 23.64	60 10.113 ^{13.951}	L 24 20.8761 ^{.4958}
25.0	258 51 52.77	5 03 59.07	16 26.75	60 21.514 ^{11.401}	U 25 09.3796 ^{.5035}
25.5	266 16 42.50	+5 06 21.29	16 29.03	60 29.902 ^{8.388}	L 25 21.8879 ^{.5083}
26.0	273 43 34.15	5 03 33.71	16 30.39	60 34.875 ^{+4.973}	U 26 10.3975 ^{12.5096}
26.5	281 11 25.90	4 55 36.08	16 30.73	60 36.117 ^{+1.242}	L 26 22.9049 ^{.5074}
27.0	288 39 11.01	4 42 36.23	16 29.99	60 33.422 ^{-2.695}	U 27 11.4066 ^{.5017}
27.5	296 05 40.68	4 24 50.03	16 28.16	60 26.719 ^{6.703}	L 27 23.8998 ^{.4932}
28.0	303 29 47.06	+4 02 40.78	16 25.27	60 16.076 ^{10.643}	... ..
28.5	310 50 26.18	3 36 38.14	16 21.35	60 01.703 ^{-14.373}	U 28 12.3823 ^{...}
29.0	318 06 40.68	3 07 16.70	16 16.51	59 43.941 ^{17.762}	L 29 00.8525 ^{12.4702}
29.5	325 17 41.85	2 35 14.23	16 10.87	59 23.242 ^{20.699}	U 29 13.3097 ^{.4572}
30.0	332 22 51.13	2 01 10.04	16 04.58	59 00.139 ^{23.103}	L 30 01.7540 ^{.4443}
30.5	339 21 40.82	+1 25 43.29	15 57.79	58 35.221 ^{24.918}	U 30 14.1857 ^{.4317}
31.0	346 13 54.26	0 49 31.73	15 50.67	58 09.101 ^{-26.120}	L 31 02.6059 ^{12.4202}
31.5	352 59 25.31	+0 13 10.57	15 43.39	57 42.388 ^{26.713}	U 31 15.0157 ^{.4098}
Feb. 1.0	359 38 17.53	-0 22 48.12	15 36.11	57 15.662 ^{26.726}	L 1 03.4166 ^{.4009}
1.5	6 10 43.07	0 57 55.82	15 28.97	56 49.462 ^{26.200}	U 1 15.8101 ^{.3935}
2.0	12 37 01.31	-1 31 47.64	15 22.11	56 24.269 ^{25.193}	L 2 04.1975 ^{.3874}
2.5	18 57 37.64	2 04 02.13	15 15.63	56 00.498 ^{-23.771}	U 2 16.5806 ^{12.3831}
3.0	25 13 02.12	2 34 21.06	15 09.64	55 38.500 ^{21.998}	L 3 04.9605 ^{.3799}
3.5	31 23 48.28	3 02 29.02	15 04.21	55 18.559 ^{19.941}	U 3 17.3388 ^{.3783}
4.0	37 30 32.09	3 28 13.00	14 59.39	55 00.893 ^{17.666}	L 4 05.7165 ^{.3777}
4.5	43 33 50.93	-3 51 22.01	14 55.25	54 45.663 ^{15.230}	U 4 18.0947 ^{.3782}
5.0	49 34 22.85	4 11 46.70	14 51.79	54 32.975 ^{-12.688}	L 5 06.4743 ^{12.3796}
5.5	55 32 45.76	4 29 19.06	14 49.04	54 22.882 ^{10.093}	U 5 18.8560 ^{.3817}
6.0	61 29 36.87	4 43 52.14	14 47.00	54 15.398 ^{7.484}	L 6 07.2402 ^{.3842}
6.5	67 25 32.18	4 55 19.94	14 45.66	54 10.491 ^{4.907}	U 6 19.6274 ^{.3872}
7.0	73 21 05.98	-5 03 37.24	14 45.01	54 08.099 ^{-2.392}	L 7 08.0176 ^{.3902}
7.5	79 16 50.51	5 08 39.64	14 45.02	54 08.125 ^{+0.026}	U 7 20.4107 ^{12.3931}
8.0	85 13 15.60	5 10 23.56	14 45.65	54 10.444 ^{2.319}	L 8 08.8064 ^{.3957}
8.5	91 10 48.47	5 08 46.39	14 46.87	54 14.908 ^{4.464}	U 8 21.2043 ^{.3979}
9.0	97 09 53.45	5 03 46.61	14 48.62	54 21.347 ^{6.439}	L 9 09.6039 ^{.3996}
9.5	103 10 51.92	-4 55 24.04	14 50.86	54 29.572 ^{8.225}	U 9 22.0045 ^{.4006}
10.0	109 14 02.16	4 43 40.07	14 53.53	54 39.382 ^{+9.810}	L 10 10.4056 ^{12.4011}
10.5	115 19 39.42	4 28 37.93	14 56.58	54 50.565 ^{11.183}	U 10 22.8065 ^{.4009}
11.0	121 27 55.95	4 10 22.95	14 59.94	55 02.903 ^{12.338}	L 11 11.2069 ^{.4004}
11.5	127 39 01.17	3 49 02.80	15 03.56	55 16.179 ^{13.276}	U 11 23.6063 ^{.3994}
12.0	133 53 01.88	-3 24 47.73	15 07.37	55 30.181 ^{14.002}	... ..
12.5	140 10 02.62	2 57 50.67	15 11.33	55 44.705 ^{+14.524}	L 12 12.0046 ^{...}
13.0	146 30 05.96	2 28 27.37	15 15.38	55 59.563 ^{14.858}	U 13 00.4019 ^{12.3973}
13.5	152 53 12.98	1 56 56.33	15 19.47	56 14.587 ^{15.024}	L 13 12.7984 ^{.3965}
14.0	159 19 23.63	1 23 38.78	15 23.57	56 29.631 ^{15.044}	U 14 01.1945 ^{.3961}
14.5	165 48 37.20	-0 48 58.44	15 27.64	56 44.573 ^{14.942}	L 14 13.5910 ^{.3965}
15.0	172 20 52.69	-0 13 21.28	15 31.66	56 59.316 ^{+14.743}	U 15 01.9886 ^{12.3976}

MOON, 1960

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Feb. 15.0	172° 20' 52".69	-0° 13' 21".28	15' 31".66	56' 59".316	U 15 01.9886 ^h
15.5	178 56 09.10	+0 22 44.84	15 35.60	57 13.788 +14.472	L 15 14.3884 ^h
16.0	185 34 25.70	0 58 50.58	15 39.46	57 27.937 14.149	U 16 02.7914 ^h
16.5	192 15 42.14	1 34 25.51	15 43.21	57 41.728 13.791	L 16 15.1988 ^h
17.0	198 59 58.42	2 08 58.64	15 46.87	57 55.137 13.409	U 17 03.6118 ^h
					13.004
17.5	205 47 14.73	+2 41 58.85	15 50.41	58 08.141	L 17 16.0316 ^h
18.0	212 37 31.14	3 12 55.40	15 53.84	58 20.715 +12.574	U 18 04.4592 ^h
18.5	219 30 47.19	3 41 18.43	15 57.13	58 32.818 12.103	L 18 16.8956 ^h
19.0	226 27 01.28	4 06 39.46	16 00.29	58 44.391 11.573	U 19 05.3413 ^h
19.5	233 26 10.04	4 28 31.87	16 03.27	58 55.345 10.954	L 19 17.7965 ^h
					10.216
20.0	240 28 07.61	+4 46 31.51	16 06.05	59 05.561	U 20 06.2611 ^h
20.5	247 32 44.93	5 00 17.28	16 08.59	59 14.886 + 9.325	L 20 18.7343 ^h
21.0	254 39 49.13	5 09 31.66	16 10.84	59 23.133 8.247	U 21 07.2149 ^h
21.5	261 49 02.92	5 14 01.41	16 12.74	59 30.087 6.954	L 21 19.7011 ^h
22.0	269 00 04.36	5 13 38.14	16 14.21	59 35.510 5.423	U 22 08.1906 ^h
					3.647
22.5	276 12 26.74	+5 08 18.84	16 15.21	59 39.157 + 1.628	L 22 20.6809 ^h
23.0	283 25 38.77	4 58 06.33	16 15.65	59 40.785 - 0.614	U 23 09.1694 ^h
23.5	290 39 05.13	4 43 09.52	16 15.48	59 40.171 3.038	L 23 21.6538 ^h
24.0	297 52 07.30	4 23 43.43	16 14.66	59 37.133 5.595	U 24 10.1318 ^h
24.5	305 04 04.64	4 00 08.97	16 13.13	59 31.538 8.212	L 24 22.6018 ^h
25.0	312 14 15.67	+3 32 52.37	16 10.89	59 23.326 -10.813	U 25 11.0625 ^h
25.5	319 21 59.53	3 02 24.42	16 07.95	59 12.513 13.313	L 25 23.5134 ^h
26.0	326 26 37.39	2 29 19.39	16 04.32	58 59.200 15.629	U 26 11.9541 ^h
26.5	333 27 33.76	1 54 13.88	16 00.06	58 43.571 17.681	...
27.0	340 24 17.68	1 17 45.50	15 55.25	58 25.890 19.404	L 27 00.3851 ^h
					...
27.5	347 16 23.65	+0 40 31.68	15 49.96	58 06.486 -20.741	U 27 12.8068 ^h
28.0	354 03 32.30	+0 03 08.53	15 44.31	57 45.745 21.659	L 28 01.2202 ^h
28.5	0 45 30.77	-0 33 50.06	15 38.41	57 24.086 22.134	U 28 13.6262 ^h
29.0	7 22 12.78	1 09 53.12	15 32.38	57 01.952 22.166	L 29 02.0260 ^h
29.5	13 53 38.60	1 44 33.05	15 26.34	56 39.786 21.764	U 29 14.4206 ^h
					...
Mar. 1.0	20 19 54.60	-2 17 25.78	15 20.41	56 18.022 -20.951	L 1 02.8113 ^h
1.5	26 41 12.87	2 48 10.79	15 14.70	55 57.071 19.763	U 1 15.1991 ^h
2.0	32 57 50.63	3 16 30.96	15 09.32	55 37.308 18.234	L 2 03.5851 ^h
2.5	39 10 09.58	3 42 12.23	15 04.35	55 19.074 16.412	U 2 15.9701 ^h
3.0	45 18 35.23	4 05 03.31	14 59.88	55 02.662 14.339	L 3 04.3549 ^h
					...
3.5	51 23 36.29	-4 24 55.20	14 55.97	54 48.323 -12.063	U 3 16.7403 ^h
4.0	57 25 44.00	4 41 40.90	14 52.68	54 36.260 9.628	L 4 05.1267 ^h
4.5	63 25 31.51	4 55 14.98	14 50.06	54 26.632 7.078	U 4 17.5146 ^h
5.0	69 23 33.33	5 05 33.30	14 48.13	54 19.554 4.456	L 5 05.9041 ^h
5.5	75 20 24.78	5 12 32.78	14 46.92	54 15.098 - 1.804	U 5 18.2955 ^h
					...
6.0	81 16 41.51	-5 16 11.19	14 46.43	54 13.294 + 0.842	L 6 06.6886 ^h
6.5	87 12 58.98	5 16 27.08	14 46.66	54 14.136 3.438	U 6 19.0834 ^h
7.0	93 09 52.03	5 13 19.73	14 47.59	54 17.574 5.952	L 7 07.4795 ^h
7.5	99 07 54.44	5 06 49.23	14 49.21	54 23.526 8.344	U 7 19.8768 ^h
8.0	105 07 38.48	4 56 56.60	14 51.49	54 31.870 10.577	L 8 08.2749 ^h
					...
8.5	111 09 34.51	-4 43 43.98	14 54.37	54 42.447 +12.618	U 8 20.6735 ^h
9.0	117 14 10.56	-4 27 14.87	14 57.81	54 55.065	L 9 09.0724 ^h

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Mar. 9-0	117° 14' 10".56	-4° 27' 14".87	14' 57".81	54' 55".065	L 9 09.0724 ^h
9-5	123 21 51.94	4 07 34.47	15 01.74	55 09.496 ^{+14.431}	U 9 21.4715 ^{12.3991}
10-0	129 33 00.86	3 44 49.99	15 06.09	55 25.483 ^{15.987}	L 10 09.8706 ^{.3991}
10-5	135 47 56.05	3 19 11.04	15 10.80	55 42.738 ^{17.255}	U 10 22.2699 ^{.3993}
11-0	142 06 52.49	2 50 49.91	15 15.76	56 00.949 ^{18.211}	L 11 10.6695 ^{.3996}
				18.839	.4003
11-5	148 30 01.11	-2 20 01.91	15 20.89	56 19.788 ^{+19.126}	U 11 23.0698 ^{12.4017}
12-0	154 57 28.68	1 47 05.59	15 26.10	56 38.914 ^{19.073}	L 12 11.4715 ^{.4035}
12-5	161 29 17.61	1 12 22.80	15 31.30	56 57.987 ^{18.686}	U 12 23.8750 ^{.4062}
13-0	168 05 26.07	-0 36 18.73	15 36.39	57 16.673 ^{17.986}	... ..
13-5	174 45 47.98	+0 00 38.33	15 41.29	57 34.659 ^{17.000}	L 13 12.2812 ^{.4097}
14-0	181 30 13.32	+0 37 57.34	15 45.92	57 51.659 ^{+15.768}	U 14 00.6909 ^{12.4142}
14-5	188 18 28.45	1 15 05.09	15 50.22	58 07.427 ^{14.336}	L 14 13.1051 ^{.4195}
15-0	195 10 16.51	1 51 26.87	15 54.12	58 21.763 ^{12.757}	U 15 01.5246 ^{.4258}
15-5	202 05 18.01	2 26 27.32	15 57.60	58 34.520 ^{11.080}	L 15 13.9504 ^{.4328}
16-0	209 03 11.36	2 59 31.37	16 00.62	58 45.600 ^{9.360}	U 16 02.3832 ^{.4404}
16-5	216 03 33.54	+3 30 05.16	16 03.17	58 54.960 ^{+7.644}	L 16 14.8236 ^{12.4484}
17-0	223 06 00.67	3 57 36.95	16 05.25	59 02.604 ^{5.970}	U 17 03.2720 ^{.4563}
17-5	230 10 08.61	4 21 37.97	16 06.87	59 08.574 ^{4.369}	L 17 15.7283 ^{.4638}
18-0	237 15 33.45	4 41 43.14	16 08.06	59 12.943 ^{2.858}	U 18 04.1921 ^{.4707}
18-5	244 21 51.96	4 57 31.62	16 08.84	59 15.801 ^{1.447}	L 18 16.6628 ^{.4761}
19-0	251 28 41.88	+5 08 47.29	16 09.24	59 17.248 ^{+0.132}	U 19 05.1389 ^{12.4801}
19-5	258 35 42.09	5 15 19.00	16 09.27	59 17.380 ^{-1.099}	L 19 17.6190 ^{.4820}
20-0	265 42 32.73	5 17 00.73	16 08.97	59 16.281 ^{2.264}	U 20 06.1010 ^{.4818}
20-5	272 48 55.09	5 13 51.57	16 08.36	59 14.017 ^{3.385}	L 20 18.5828 ^{.4796}
21-0	279 54 31.56	5 05 55.73	16 07.44	59 10.632 ^{4.485}	U 21 07.0624 ^{.4753}
21-5	286 59 05.41	+4 53 22.29	16 06.21	59 06.147 ^{-5.586}	L 21 19.5377 ^{12.4692}
22-0	294 02 20.63	4 36 25.04	16 04.69	59 00.561 ^{6.705}	U 22 08.0069 ^{.4620}
22-5	301 04 01.68	4 15 22.08	16 02.86	58 53.856 ^{7.852}	L 22 20.4689 ^{.4537}
23-0	308 03 53.38	3 50 35.54	16 00.73	58 46.004 ^{9.027}	U 23 08.9226 ^{.4450}
23-5	315 01 40.73	3 22 31.02	15 58.27	58 36.977 ^{10.225}	L 23 21.3676 ^{.4362}
24-0	321 57 08.95	+2 51 37.08	15 55.48	58 26.752 ^{-11.428}	U 24 09.8038 ^{12.4277}
24-5	328 50 03.48	2 18 24.64	15 52.37	58 15.324 ^{12.612}	L 24 22.2315 ^{.4198}
25-0	335 40 10.17	1 43 26.25	15 48.93	58 02.712 ^{13.744}	U 25 10.6513 ^{.4126}
25-5	342 27 15.45	1 07 15.37	15 45.19	57 48.968 ^{14.789}	L 25 23.0639 ^{.4062}
26-0	349 11 06.68	+0 30 25.61	15 41.16	57 34.179 ^{15.707}	U 26 11.4701 ^{.4010}
26-5	355 51 32.49	-0 06 30.00	15 36.88	57 18.472 ^{-16.458}	L 26 23.8711 ^{12.3967}
27-0	2 28 23.21	0 42 59.76	15 32.39	57 02.014 ^{17.008}	... ..
27-5	9 01 31.21	1 18 33.84	15 27.76	56 45.006 ^{17.324}	U 27 12.2678 ^{.3934}
28-0	15 30 51.34	1 52 44.88	15 23.04	56 27.682 ^{17.382}	L 28 00.6612 ^{.3910}
28-5	21 56 21.28	2 25 08.28	15 18.30	56 10.300 ^{17.164}	U 28 13.0522 ^{.3895}
29-0	28 18 01.78	-2 55 22.48	15 13.63	55 53.136 ^{-16.660}	L 29 01.4417 ^{12.3887}
29-5	34 35 56.92	3 23 09.04	15 09.09	55 36.476 ^{15.867}	U 29 13.8304 ^{.3886}
30-0	40 50 14.22	3 48 12.58	15 04.77	55 20.609 ^{14.792}	L 30 02.2190 ^{.3889}
30-5	47 01 04.71	4 10 20.69	15 00.74	55 05.817 ^{13.447}	U 30 14.6079 ^{.3896}
31-0	53 08 42.88	4 29 23.66	14 57.07	54 52.370 ^{11.847}	L 31 02.9975 ^{.3906}
31-5	59 13 26.62	-4 45 14.20	14 53.84	54 40.523 ^{-10.015}	U 31 15.3881 ^{12.3915}
Apr. 1-0	65 15 37.01	-4 57 47.17	14 51.12	54 30.508	L 1 03.7796

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Apr. 1.0	65° 15' 37.01	-4° 57' 47.17	14' 51.12	54' 30.508 - 7.977	L 1 03.7796 ^{d h} 12.3926
1.5	71 15 38.14	5 06 59.22	14 48.94	54 22.531 5.761	U 1 16.1722 .3934
2.0	77 13 56.78	5 12 48.53	14 47.37	54 16.770 3.394	L 2 04.5656 .3941
2.5	83 11 02.15	5 15 14.50	14 46.45	54 13.376 - 0.912	U 2 16.9597 .3946
3.0	89 07 25.54	5 14 17.58	14 46.20	54 12.464 + 1.653	L 3 05.3543 .3947
3.5	95 03 39.97	-5 09 59.10	14 46.65	54 14.117 + 4.264	U 3 17.7490 12.3948
4.0	101 00 19.78	5 02 21.16	14 47.81	54 18.381 6.886	L 4 06.1438 .3944
4.5	106 58 00.26	4 51 26.68	14 49.69	54 25.267 9.478	U 4 18.5382 .3942
5.0	112 57 17.11	4 37 19.37	14 52.27	54 34.745 11.996	L 5 06.9324 .3939
5.5	118 58 46.04	4 20 03.94	14 55.54	54 46.741 14.399	U 5 19.3263 .3937
6.0	125 03 02.15	-3 59 46.28	14 59.46	55 01.140 + 16.636	L 6 07.7200 12.3939
6.5	131 10 39.43	3 36 33.73	15 03.99	55 17.776 18.660	U 6 20.1139 .3943
7.0	137 22 10.02	3 10 35.41	15 09.08	55 36.436 20.419	L 7 08.5082 .3954
7.5	143 38 03.57	2 42 02.64	15 14.64	55 56.855 21.862	U 7 20.9036 .3972
8.0	149 58 46.45	2 11 09.31	15 20.60	56 18.717 22.938	L 8 09.3008 .3997
8.5	156 24 40.93	-1 38 12.27	15 26.85	56 41.655 + 23.603	U 8 21.7005 12.4033
9.0	162 56 04.37	1 03 31.68	15 33.28	57 05.258 23.817	L 9 10.1038 .4077
9.5	169 33 08.37	-0 27 31.23	15 39.77	57 29.075 23.552	U 9 22.5115 .4134
10.0	176 15 58.02	+0 09 21.73	15 46.18	57 52.627 22.791	L 10 10.9249 .4199
10.5	183 04 31.19	0 46 36.35	15 52.39	58 15.418 21.539	U 10 23.3448 .4275
11.0	189 58 38.12	+1 23 38.60	15 58.26	58 36.957 + 19.816	L 11 11.7723 12.4361
11.5	196 58 01.09	1 59 51.93	16 03.66	58 56.773 17.664	... ..
12.0	204 02 14.55	2 34 38.14	16 08.47	59 14.437 15.147	U 12 00.2084 .4452
12.5	211 10 45.58	3 07 18.60	16 12.60	59 29.584 12.342	L 12 12.6536 .4547
13.0	218 22 54.69	3 37 15.56	16 15.96	59 41.926 9.345	U 13 01.1083 .4641
13.5	225 37 57.08	+4 03 53.56	16 18.51	59 51.271 + 6.255	L 13 13.5724 12.4731
14.0	232 55 04.19	4 26 40.88	16 20.21	59 57.526 3.171	U 14 02.0455 .4811
14.5	240 13 25.51	4 45 10.70	16 21.08	60 00.697 + 0.191	L 14 14.5266 .4873
15.0	247 32 10.46	4 59 02.15	16 21.13	60 00.888 - 2.608	U 15 03.0139 .4917
15.5	254 50 30.30	5 08 00.90	16 20.42	59 58.280 5.156	L 15 15.5056 .4935
16.0	262 07 39.78	+5 11 59.44	16 19.01	59 53.124 - 7.413	U 16 03.9991 12.4926
16.5	269 22 58.54	5 10 57.01	16 16.99	59 45.711 9.350	L 16 16.4917 .4893
17.0	276 35 52.10	5 04 59.22	16 14.44	59 36.361 10.965	U 17 04.9810 .4835
17.5	283 45 52.39	4 54 17.42	16 11.46	59 25.396 12.265	L 17 17.4645 .4758
18.0	290 52 37.91	4 39 07.94	16 08.12	59 13.131 13.277	U 18 05.9403 .4665
18.5	297 55 53.49	+4 19 51.25	16 04.50	58 59.854 - 14.034	L 18 18.4068 12.4564
19.0	304 55 29.73	3 56 51.19	16 00.68	58 45.820 14.574	U 19 06.8632 .4458
19.5	311 51 22.24	3 30 34.12	15 56.70	58 31.246 14.935	L 19 19.3090 .4355
20.0	318 43 30.71	3 01 28.27	15 52.64	58 16.311 15.158	U 20 07.7445 .4255
20.5	325 31 57.99	2 30 03.12	15 48.51	58 01.153 15.277	L 20 20.1700 .4165
21.0	332 16 49.11	+1 56 48.85	15 44.34	57 45.876 - 15.318	U 21 08.5865 12.4084
21.5	338 58 10.47	1 22 15.87	15 40.17	57 30.558 15.303	L 21 20.9949 .4016
22.0	345 36 09.08	0 46 54.43	15 36.00	57 15.255 15.248	U 22 09.3965 .3960
22.5	352 10 51.95	+0 11 14.22	15 31.85	57 00.007 15.154	L 22 21.7925 .3916
23.0	358 42 25.71	-0 24 15.96	15 27.72	56 44.853 15.025	U 23 10.1841 .3884
23.5	5 10 56.30	-0 59 08.55	15 23.62	56 29.828 - 14.849	L 23 22.5725 12.3864
24.0	11 36 28.91	-1 32 57.51	15 19.58	56 14.979	U 24 10.9589

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Apr. 24.0	11 36 28.91	-1 32 57.51	15 19.58	56 14.979	U 24 10.9589 ^{d h} L 24 23.3443 ^h
24.5	17 59 07.97	2 05 18.63	15 15.60	56 00.361	U 24 23.3443 ^h L 24 23.3443 ^h
25.0	24 18 57.40	2 35 49.77	15 11.70	55 46.050	U 25 11.7295 ^h L 25 11.7295 ^h
25.5	30 36 00.83	3 04 11.06	15 07.91	55 32.135	U 25 11.7295 ^h L 25 11.7295 ^h
26.0	36 50 21.99	3 30 05.05	15 04.25	55 18.727	U 26 00.1153 ^h L 26 00.1153 ^h
26.5	43 02 05.13	-3 53 16.80	15 00.77	55 05.955	U 26 12.5022 ^h L 26 12.5022 ^h
27.0	49 11 15.43	4 13 33.94	14 57.51	54 53.964	U 27 00.8905 ^h L 27 00.8905 ^h
27.5	55 17 59.43	4 30 46.58	14 54.50	54 42.914	U 27 13.2805 ^h L 27 13.2805 ^h
28.0	61 22 25.47	4 44 47.26	14 51.79	54 32.975	U 28 01.6721 ^h L 28 01.6721 ^h
28.5	67 24 44.00	4 55 30.75	14 49.43	54 24.323	U 28 14.0652 ^h L 28 14.0652 ^h
29.0	73 25 07.88	-5 02 53.92	14 47.47	54 17.138	U 29 02.4595 ^h L 29 02.4595 ^h
29.5	79 23 52.64	5 06 55.48	14 45.96	54 11.597	U 29 14.8545 ^h L 29 14.8545 ^h
30.0	85 21 16.54	5 07 35.76	14 44.95	54 07.872	U 30 03.2497 ^h L 30 03.2497 ^h
30.5	91 17 40.71	5 04 56.51	14 44.47	54 06.123	U 30 15.6447 ^h L 30 15.6447 ^h
May 1.0	97 13 29.10	4 59 00.69	14 44.58	54 06.500	U 1 04.0390 ^h L 1 04.0390 ^h
1.5	103 09 08.43	-4 49 52.31	14 45.29	54 09.131	U 1 16.4322 ^h L 1 16.4322 ^h
2.0	109 05 08.03	4 37 36.32	14 46.65	54 14.125	U 2 04.8240 ^h L 2 04.8240 ^h
2.5	115 01 59.62	4 22 18.53	14 48.68	54 21.563	U 2 17.2143 ^h L 2 17.2143 ^h
3.0	121 00 16.98	4 04 05.65	14 51.39	54 31.497	U 3 05.6031 ^h L 3 05.6031 ^h
3.5	127 00 35.62	3 43 05.32	14 54.78	54 43.944	U 3 17.9907 ^h L 3 17.9907 ^h
4.0	133 03 32.34	-3 19 26.25	14 58.85	54 58.882	U 4 06.3774 ^h L 4 06.3774 ^h
4.5	139 09 44.61	2 53 18.46	15 03.58	55 16.242	U 4 18.7640 ^h L 4 18.7640 ^h
5.0	145 19 49.99	2 24 53.51	15 08.93	55 35.906	U 5 07.1511 ^h L 5 07.1511 ^h
5.5	151 34 25.33	1 54 24.86	15 14.87	55 57.696	U 5 19.5398 ^h L 5 19.5398 ^h
6.0	157 54 05.82	1 22 08.21	15 21.32	56 21.374	U 6 07.9311 ^h L 6 07.9311 ^h
6.5	164 19 23.97	-0 48 21.91	15 28.20	56 46.634	U 6 20.3264 ^h L 6 20.3264 ^h
7.0	170 50 48.41	-0 13 27.32	15 35.41	57 13.103	U 7 08.7269 ^h L 7 08.7269 ^h
7.5	177 28 42.53	+0 22 10.95	15 42.83	57 40.335	U 7 21.1341 ^h L 7 21.1341 ^h
8.0	184 13 23.06	0 58 04.79	15 50.32	58 07.821	U 8 09.5494 ^h L 8 09.5494 ^h
8.5	191 04 58.67	1 33 42.69	15 57.73	58 34.994	U 8 21.9742 ^h L 8 21.9742 ^h
9.0	198 03 28.51	+2 08 30.00	16 04.88	59 01.242	U 9 10.4096 ^h L 9 10.4096 ^h
9.5	205 08 41.10	2 41 49.52	16 11.60	59 25.931	U 9 22.8568 ^h L 9 22.8568 ^h
10.0	212 20 13.46	3 13 02.51	16 17.73	59 48.431	U 10 11.3164 ^h L 10 11.3164 ^h
10.5	219 37 30.78	3 41 29.92	16 23.10	60 08.141	U 10 23.7883 ^h L 10 23.7883 ^h
11.0	226 59 46.81	4 06 34.00	16 27.57	60 24.529	U 11 12.2723 ^h L 11 12.2723 ^h
11.5	234 26 04.91	+4 27 40.08	16 31.01	60 37.158	U 12 00.7669 ^h L 12 00.7669 ^h
12.0	241 55 19.98	4 44 18.33	16 33.34	60 45.714	U 12 13.2703 ^h L 12 13.2703 ^h
12.5	249 26 21.01	4 56 05.35	16 34.52	60 50.028	U 13 01.7796 ^h L 13 01.7796 ^h
13.0	256 57 54.16	5 02 45.38	16 34.53	60 50.080	U 13 14.2915 ^h L 13 14.2915 ^h
13.5	264 28 46.15	5 04 11.06	16 33.42	60 46.002	U 14 02.8026 ^h L 14 02.8026 ^h
14.0	271 57 47.44	+5 00 23.59	16 31.25	60 38.061	U 14 15.3093 ^h L 14 15.3093 ^h
14.5	279 23 55.16	4 51 32.26	16 28.14	60 26.634	U 15 03.8085 ^h L 15 03.8085 ^h
15.0	286 46 15.35	4 37 53.62	16 24.20	60 12.184	U 15 16.2974 ^h L 15 16.2974 ^h
15.5	294 04 04.39	4 19 50.24	16 19.58	59 55.225	U 16 04.7745 ^h L 16 04.7745 ^h
16.0	301 16 49.75	3 57 49.29	16 14.43	59 36.290	U 16 17.2385 ^h L 16 17.2385 ^h
16.5	308 24 09.86	+3 32 21.14	16 08.87	59 15.907	U 17 05.6892 ^h L 17 05.6892 ^h
17.0	315 25 53.45	+3 03 58.08	16 03.06	58 54.571	U 17 05.6892 ^h L 17 05.6892 ^h

MOON, 1960

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
	° ′ ″	° ′ ″	′ ″	′ ″	^d ^h
May 17.0	315 25 53.45	+3 03 58.08	16 03.06	58 54.571 -21.836	U 17 05.6892 ^h 12.4377
17.5	322 21 58.39	2 33 13.14	15 57.11	58 32.735 21.945	L 17 18.1269 .4256
18.0	329 12 30.24	2 00 39.23	15 51.13	58 10.790 21.721	U 18 06.5525 .4147
18.5	335 57 40.70	1 26 48.47	15 45.21	57 49.069 21.231	L 18 18.9672 .4051
19.0	342 37 46.01	0 52 11.68	15 39.43	57 27.838 20.532	U 19 07.3723 .3970
19.5	349 13 05.50	+0 17 18.16	15 33.84	57 07.306 -19.680	L 19 19.7693 12.3907
20.0	355 44 00.28	-0 17 24.54	15 28.47	56 47.626 18.722	U 20 08.1600 .3858
20.5	2 10 52.09	0 51 30.65	15 23.37	56 28.904 17.697	L 20 20.5458 .3823
21.0	8 34 02.39	1 24 36.25	15 18.55	56 11.207 16.635	U 21 08.9281 .3804
21.5	14 53 51.70	1 56 19.27	15 14.02	55 54.572 15.558	L 21 21.3085 .3796
22.0	21 10 38.99	-2 26 19.47	15 09.78	55 39.014 -14.482	U 22 09.6881 12.3799
22.5	27 24 41.50	2 54 18.50	15 05.84	55 24.532 13.414	L 22 22.0680 .3810
23.0	33 36 14.47	3 19 59.87	15 02.18	55 11.118 12.353	U 23 10.4490 .3829
23.5	39 45 31.27	3 43 09.02	14 58.81	54 58.765 11.295	L 23 22.8319 .3851
24.0	45 52 43.50	4 03 33.35	14 55.74	54 47.470 10.232	U 24 11.2170 .3876
24.5	51 58 01.28	-4 21 02.25	14 52.95	54 37.238 -9.149	L 24 23.6046 12.3900
25.0	58 01 33.66	4 35 27.13	14 50.46	54 28.089 8.033	U 25 11.9946 .3922
25.5	64 03 29.01	4 46 41.44	14 48.27	54 20.056 6.868	... ..
26.0	70 03 55.54	4 54 40.61	14 46.40	54 13.188 5.636	L 26 00.3868 .3940
26.5	76 03 01.81	4 59 22.06	14 44.86	54 07.552 4.325	U 26 12.7808 .3951
27.0	82 00 57.22	-5 00 45.07	14 43.68	54 03.227 -2.920	L 27 01.1759 12.3956
27.5	87 57 52.48	4 58 50.68	14 42.89	54 00.307 -1.410	U 27 13.5715 .3954
28.0	93 54 00.06	4 53 41.58	14 42.50	53 58.897 +0.212	L 28 01.9669 .3944
28.5	99 49 34.55	4 45 21.93	14 42.56	53 59.109 1.949	U 28 14.3613 .3928
29.0	105 44 52.98	4 33 57.28	14 43.09	54 01.058 3.804	L 29 02.7541 .3908
29.5	111 40 14.98	-4 19 34.37	14 44.13	54 04.862 +5.770	U 29 15.1449 12.3883
30.0	117 36 03.03	4 02 21.09	14 45.70	54 10.632 7.840	L 30 03.5332 .3859
30.5	123 32 42.40	3 42 26.35	14 47.84	54 18.472 9.999	U 30 15.9191 .3835
31.0	129 30 41.18	3 20 00.06	14 50.56	54 28.471 12.228	L 31 04.3026 .3815
31.5	135 30 30.08	2 55 13.14	14 53.89	54 40.699 14.497	U 31 16.6841 .3802
June 1.0	141 32 42.23	-2 28 17.62	14 57.84	54 55.196 +16.779	L 1 05.0643 12.3796
1.5	147 37 52.79	1 59 26.69	15 02.41	55 11.975 19.030	U 1 17.4439 .3801
2.0	153 46 38.45	1 28 54.97	15 07.60	55 31.005 21.205	L 2 05.8240 .3818
2.5	159 59 36.78	0 56 58.67	15 13.38	55 52.210 23.244	U 2 18.2058 .3848
3.0	166 17 25.47	-0 23 55.90	15 19.71	56 15.454 25.089	L 3 06.5906 .3895
3.5	172 40 41.23	+0 09 53.06	15 26.54	56 40.543 +26.664	U 3 18.9801 12.3958
4.0	179 09 58.73	0 44 05.48	15 33.81	57 07.207 27.893	L 4 07.3759 .4037
4.5	185 45 49.04	1 18 15.94	15 41.41	57 35.100 28.694	U 4 19.7796 .4133
5.0	192 28 38.14	1 51 56.21	15 49.23	58 03.794 28.988	L 5 08.1929 .4247
5.5	199 18 45.08	2 24 35.26	15 57.12	58 32.782 28.696	U 5 20.6176 .4374
6.0	206 16 20.15	+2 55 39.59	16 04.94	59 01.478 +27.756	L 6 09.0550 12.4514
6.5	213 21 22.99	3 24 33.72	16 12.50	59 29.234 26.119	U 6 21.5064 .4660
7.0	220 33 41.02	3 50 41.12	16 19.62	59 55.353 23.770	L 7 09.9724 .4807
7.5	227 52 48.15	4 13 25.50	16 26.10	60 19.123 20.722	U 7 22.4531 .4946
8.0	235 18 04.21	4 32 12.38	16 31.74	60 39.845 17.029	L 8 10.9477 .5069
8.5	242 48 35.22	+4 46 30.88	16 36.38	60 56.874 +12.789	U 8 23.4546 12.5166
9.0	250 23 14.61	+4 55 55.64	16 39.86	61 09.663	L 9 11.9712

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
June 9-0	250° 23' 14".61	+4° 55' 55".64	16' 39".86	61' 09".663 + 8".132	L 9 11.9712 ^h 12.5227
9-5	258 00 45.58	5 00 08.53	16 42.08	61 17.795 + 3.224	... ..
10-0	265 39 44.29	4 59 00.01	16 42.96	61 21.019 - 1.753	U 10 00.4939 ...
10-5	273 18 43.77	4 52 29.96	16 42.48	61 19.266 - 6.614	L 10 13.0187 .5248
11-0	280 56 18.13	4 40 47.74	16 40.68	61 12.652 11.182	U 11 01.5413 .5226
11-5	288 31 06.60	+4 24 11.61	16 37.63	61 01.470 - 15.308	L 11 14.0576 .5163
12-0	296 01 57.09	4 03 07.47	16 33.46	60 46.162 18.875	U 12 02.5642 12.5066
12-5	303 27 48.80	3 38 07.26	16 28.32	60 27.287 21.806	L 12 15.0584 .4942
13-0	310 47 53.92	3 09 47.01	16 22.38	60 05.481 24.064	U 13 03.5384 .4800
13-5	318 01 38.23	2 38 44.99	16 15.82	59 41.417 25.651	L 13 16.0036 .4652
14-0	325 08 40.81	+2 05 40.05	16 08.83	59 15.766 - 26.597	U 14 04.4539 12.4362
14-5	332 08 53.02	1 31 10.21	16 01.59	58 49.169 26.953	L 14 16.8901 .4232
15-0	339 02 16.98	0 55 51.59	15 54.24	58 22.216 26.793	U 15 05.3133 .4117
15-5	345 49 03.77	+0 20 17.80	15 46.94	57 55.423 26.189	L 15 17.7250 .4020
16-0	352 29 31.55	-0 15 00.47	15 39.81	57 29.234 25.225	U 16 06.1270 .3940
16-5	359 04 03.77	-0 49 35.59	15 32.94	57 04.009 - 23.975	L 16 18.5210 12.3877
17-0	5 33 07.43	1 23 02.87	15 26.41	56 40.034 22.511	U 17 06.9087 .3832
17-5	11 57 11.66	1 55 00.48	15 20.27	56 17.523 20.898	L 17 19.2919 .3801
18-0	18 16 46.44	2 25 09.15	15 14.58	55 56.625 19.191	U 18 07.6720 .3786
18-5	24 32 21.59	2 53 11.96	15 09.35	55 37.434 17.436	L 18 20.0506 .3783
19-0	30 44 25.99	-3 18 54.11	15 04.60	55 19.998 - 15.669	U 19 08.4289 12.3790
19-5	36 53 26.90	3 42 02.75	15 00.33	55 04.329 13.922	L 19 20.8079 .3807
20-0	42 59 49.63	4 02 26.77	14 56.54	54 50.407 12.212	U 20 09.1886 .3828
20-5	49 03 57.22	4 19 56.78	14 53.21	54 38.195 10.555	L 20 21.5714 .3854
21-0	55 06 10.36	4 34 24.98	14 50.34	54 27.640 8.960	U 21 09.9568 .3880
21-5	61 06 47.44	-4 45 45.17	14 47.89	54 18.680 - 7.425	L 21 22.3448 12.3906
22-0	67 06 04.67	4 53 52.72	14 45.87	54 11.255 5.948	U 22 10.7354 .3927
22-5	73 04 16.34	4 58 44.64	14 44.25	54 05.307 4.519	L 22 23.1281 .3944
23-0	79 01 35.17	5 00 19.53	14 43.02	54 00.788 3.128	U 23 11.5225 .3952
23-5	84 58 12.67	4 58 37.67	14 42.17	53 57.660 1.761	L 23 23.9177 .3953
24-0	90 54 19.63	-4 53 40.98	14 41.69	53 55.899 - 0.401	... ..
24-5	96 50 06.59	4 45 33.01	14 41.58	53 55.498 + 0.966	U 24 12.3130 12.3946
25-0	102 45 44.32	4 34 18.91	14 41.84	53 56.464 2.357	L 25 00.7076 .3931
25-5	108 41 24.32	4 20 05.39	14 42.48	53 58.821 3.786	U 25 13.1007 .3910
26-0	114 37 19.26	4 03 00.65	14 43.51	54 02.607 5.265	L 26 01.4917 .3884
26-5	120 33 43.41	-3 43 14.27	14 44.95	54 07.872 + 6.806	U 26 13.8801 12.3856
27-0	126 30 52.99	3 20 57.19	14 46.80	54 14.678 8.416	L 27 02.2657 .3826
27-5	132 29 06.43	2 56 21.57	14 49.10	54 23.094 10.096	U 27 14.6483 .3800
28-0	138 28 44.59	2 29 40.77	14 51.85	54 33.190 11.843	L 28 03.0283 .3776
28-5	144 30 10.84	2 01 09.31	14 55.07	54 45.033 13.649	U 28 15.4059 .3762
29-0	150 33 51.07	-1 31 02.83	14 58.79	54 58.682 + 15.498	L 29 03.7821 12.3756
29-5	156 40 13.52	0 59 38.18	15 03.01	55 14.180 17.367	U 29 16.1577 .3760
30-0	162 49 48.56	-0 27 13.44	15 07.75	55 31.547 19.225	L 30 04.5337 .3780
30-5	169 03 08.23	+0 05 51.92	15 12.98	55 50.772 21.034	U 30 16.9117 .3812
July 1-0	175 20 45.66	0 39 16.98	15 18.71	56 11.806 22.746	L 1 05.2929 .3863
1-5	181 43 14.32	+1 12 39.16	15 24.91	56 34.552 + 24.303	U 1 17.6792 12.3929
2-0	188 11 07.02	+1 45 34.14	15 31.53	56 58.855	L 2 06.0721

MOON, 1960

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
July					
1.0	175 20 45.66	+0 39 16.98	15 18.71	56 11.806	L 1 05.2929 ^d 12.3863 ^h
1.5	181 43 14.32	1 12 39.16	15 24.91	56 34.552 +22.746	U 1 17.6792
2.0	188 11 07.02	1 45 34.14	15 31.53	56 58.855 24.303	L 2 06.0721 .3929
2.5	194 44 54.72	2 17 35.74	15 38.52	57 24.495 25.640	U 2 18.4734 .4013
3.0	201 25 05.15	2 48 15.95	15 45.79	57 51.180 26.685	L 3 06.8849 .4115
3.5	208 12 01.18	+3 17 05.03	15 53.24	58 18.537 27.357	U 3 19.3084 .4235
4.0	215 05 59.05	3 43 31.84	16 00.75	58 46.112 +27.575	L 4 07.7452 12.4368
4.5	222 07 06.51	4 07 04.41	16 08.18	59 13.375 27.263	U 4 20.1965 .4513
5.0	229 15 21.03	4 27 10.73	16 15.36	59 39.723 26.348	L 5 08.6629 .4664
5.5	236 30 28.13	4 43 19.93	16 22.11	60 04.498 24.775	U 5 21.1444 .4815
6.0	243 52 00.28	+4 55 03.66	16 28.24	60 27.013 22.515	L 6 09.6402 .4958
6.5	251 19 16.31	5 01 57.70	16 33.58	60 46.580 +19.567	U 6 22.1483 12.5081
7.0	258 51 21.75	5 03 43.65	16 37.93	61 02.548 15.968	L 7 10.6659 .5176
7.5	266 27 10.08	5 00 10.46	16 41.14	61 14.345 11.797	U 7 23.1895 .5236
8.0	274 05 25.01	4 51 15.73	16 43.09	61 21.520 7.175	L 8 11.7149 .5254
8.5	281 44 43.67	+4 37 06.43	16 43.71	61 23.775 +2.255	... .. 5228
9.0	289 23 40.32	4 17 58.96	16 42.95	61 20.989 -2.786	U 9 00.2377 ...
9.5	297 00 50.44	3 54 18.55	16 40.84	61 13.233 7.756	L 9 12.7541 12.5164
10.0	304 34 54.61	3 26 37.91	16 37.44	61 00.763 12.470	U 10 01.2605 .5064
10.5	312 04 41.85	2 55 35.48	16 32.87	60 43.997 16.766	L 10 13.7544 .4939
11.0	319 29 12.19	+2 21 53.34	16 27.29	60 23.492 20.505	U 11 02.2344 .4800
11.5	326 47 38.31	1 46 15.08	16 20.86	59 59.896 -23.596	L 11 14.6998 12.4654
12.0	333 59 26.14	1 09 23.91	16 13.78	59 33.913 25.983	U 12 03.1508 .4510
12.5	341 04 14.67	+0 32 01.07	16 06.24	59 06.262 27.651	L 12 15.5881 .4373
13.0	348 01 55.04	-0 05 15.33	15 58.45	58 37.638 28.624	U 13 04.0129 .4248
13.5	354 52 29.19	-0 41 51.01	15 50.56	58 08.691 28.947	L 13 16.4268 .4139
14.0	1 36 08.22	1 17 15.87	15 42.74	57 40.005 -28.686	U 14 04.8314 12.4046
14.5	8 13 10.66	1 51 03.99	15 35.14	57 12.085 27.920	L 14 17.2284 .3970
15.0	14 44 00.76	2 22 53.46	15 27.85	56 45.355 26.730	U 15 05.6195 .3911
15.5	21 09 06.95	2 52 25.98	15 20.99	56 20.156 25.199	L 15 18.0063 .3868
16.0	27 29 00.38	-3 19 26.47	15 14.61	55 56.752 23.404	U 16 06.3902 .3839
16.5	33 44 13.77	3 43 42.60	15 08.78	55 35.335 -21.417	L 16 18.7726 12.3824
17.0	39 55 20.34	4 05 04.45	15 03.52	55 16.035 19.300	U 17 07.1547 .3821
17.5	46 02 52.98	4 23 24.06	14 58.86	54 58.923 17.112	L 17 19.5374 .3827
18.0	52 07 23.62	4 38 35.21	14 54.80	54 44.029 14.894	U 18 07.9215 .3841
18.5	58 09 22.72	-4 50 33.19	14 51.34	54 31.339 12.690	L 18 20.3074 .3859
19.0	64 09 18.89	4 59 14.63	14 48.47	54 20.810 -10.529	U 19 08.6954 12.3880
19.5	70 07 38.66	5 04 37.41	14 46.18	54 12.374 8.436	L 19 21.0855 .3901
20.0	76 04 46.33	5 06 40.65	14 44.42	54 05.945 6.429	U 20 09.4776 .3921
20.5	82 01 04.01	5 05 24.73	14 43.19	54 01.424 4.521	L 20 21.8713 .3937
21.0	87 56 51.58	-5 00 51.30	14 42.45	53 58.706 2.718	U 21 10.2660 .3947
21.5	93 52 26.92	4 53 03.37	14 42.17	53 57.684 -1.022	L 21 22.6610 12.3950
22.0	99 48 06.09	4 42 05.38	14 42.33	53 58.253 +0.569	U 22 11.0556 .3946
22.5	105 44 03.61	4 28 03.26	14 42.89	54 00.313 2.060	L 22 23.4491 .3935
23.0	111 40 32.82	4 11 04.51	14 43.83	54 03.776 3.463	U 23 11.8409 .3918
23.5	117 37 46.21	-3 51 18.24	14 45.14	54 08.565 4.789	L 23 11.8409 12.3895
24.0	123 35 55.83	-3 28 55.16	14 46.79	54 14.617 +6.052	... ..
					L 24 00.2304 ...

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
July 24.0	123 35 55.83	-3 28 55.16	14 46.79	54 14.617 + 7.268	L 24 00.2304 ^{d h} 12.3870
24.5	129 35 13.70	3 04 07.62	14 48.77	54 21.885 8.451	U 24 12.6174 3842
25.0	135 35 52.20	2 37 09.53	14 51.07	54 30.336 9.618	L 25 01.0016 3816
25.5	141 38 04.46	2 08 16.33	14 53.69	54 39.954 10.784	U 25 13.3832 3793
26.0	147 42 04.64	1 37 44.93	14 56.63	54 50.738 11.959	L 26 01.7625 3774
26.5	153 48 08.26	-1 05 53.59	14 59.89	55 02.697 +13.149	U 26 14.1399 12.3764
27.0	159 56 32.35	-0 33 01.86	15 03.47	55 15.846 14.360	L 27 02.5163 3763
27.5	166 07 35.53	+0 00 29.52	15 07.38	55 30.206 15.585	U 27 14.8926 3774
28.0	172 21 38.03	0 34 18.66	15 11.63	55 45.791 16.817	L 28 03.2700 3796
28.5	178 39 01.46	1 08 02.60	15 16.21	56 02.608 18.037	U 28 15.6496 3835
29.0	185 00 08.58	+1 41 17.38	15 21.12	56 20.645 +19.220	L 29 04.0331 12.3888
29.5	191 25 22.80	2 13 38.05	15 26.36	56 39.865 20.332	U 29 16.4219 3956
30.0	197 55 07.55	2 44 38.81	15 31.90	57 00.197 21.331	L 30 04.8175 4042
30.5	204 29 45.46	3 13 53.05	15 37.71	57 21.528 22.165	U 30 17.2217 4142
31.0	211 09 37.40	3 40 53.58	15 43.75	57 43.693 22.779	L 31 05.6359 4256
Aug. 31.5	217 55 01.30	+4 05 12.89	15 49.95	58 06.472 +23.105	U 31 18.0615 12.4384
1.0	224 46 10.84	4 26 23.52	15 56.25	58 29.577 23.078	L 1 06.4999 4517
1.5	231 43 14.09	4 43 58.64	16 02.54	58 52.655 22.632	U 1 18.9516 4654
2.0	238 46 12.09	4 57 32.77	16 08.70	59 15.287 21.706	L 2 07.4170 4788
2.5	245 54 57.46	5 06 42.72	16 14.62	59 36.993 20.250	U 2 19.8958 4909
3.0	253 09 13.39	+5 11 08.66	16 20.13	59 57.243 +18.235	L 3 08.3867 12.5012
3.5	260 28 32.82	5 10 35.37	16 25.10	60 15.478 15.651	U 3 20.8879 5086
4.0	267 52 18.23	5 04 53.42	16 29.37	60 31.129 12.521	L 4 09.3965 5129
4.5	275 19 42.00	4 54 00.32	16 32.78	60 43.650 8.902	U 4 21.9094 5136
5.0	282 49 47.49	4 38 01.41	16 35.20	60 52.552 4.880	L 5 10.4230 5105
5.5	290 21 30.78	+4 17 10.37	16 36.53	60 57.432 +0.579	U 5 22.9335 12.5044
6.0	297 53 43.01	3 51 49.16	16 36.69	60 58.011 -3.861	L 6 11.4379 4954
6.5	305 25 13.19	3 22 27.46	16 35.64	60 54.150 8.279	U 6 23.9333 4845
7.0	312 54 51.09	2 49 41.55	16 33.38	60 45.871 12.517	... ..
7.5	320 21 30.17	2 14 12.63	16 29.97	60 33.354 16.426	L 7 12.4178 4725
8.0	327 44 10.10	+1 36 45.01	16 25.50	60 16.928 -19.874	U 8 00.8903 12.4601
8.5	335 01 58.83	0 58 04.05	16 20.08	59 57.054 22.765	L 8 13.3504 4478
9.0	342 14 14.03	+0 18 54.32	16 13.88	59 34.289 25.034	U 9 01.7982 4363
9.5	349 20 23.78	-0 20 02.03	16 07.06	59 09.255 26.648	L 9 14.2345 4258
10.0	356 20 06.81	0 58 06.50	15 59.80	58 42.607 27.611	U 10 02.6603 4166
10.5	3 13 12.09	-1 34 45.04	15 52.28	58 14.996 -27.947	L 10 15.0769 12.4088
11.0	9 59 38.06	2 09 28.46	15 44.66	57 47.049 27.706	U 11 03.4857 4024
11.5	16 39 31.59	2 41 52.42	15 37.11	57 19.343 26.948	L 11 15.8881 3973
12.0	23 13 06.82	3 11 37.27	15 29.77	56 52.395 25.745	U 12 04.2854 3937
12.5	29 40 43.88	3 38 27.57	15 22.76	56 26.650 24.168	L 12 16.6791 3911
13.0	36 02 47.67	-4 02 11.62	15 16.17	56 02.482 -22.289	U 13 05.0702 12.3898
13.5	42 19 46.73	4 22 40.88	15 10.10	55 40.193 20.176	L 13 17.4600 3891
14.0	48 32 12.20	4 39 49.43	15 04.60	55 20.017 17.893	U 14 05.8491 3894
14.5	54 40 36.86	4 53 33.51	14 59.73	55 02.124 15.500	L 14 18.2385 3900
15.0	60 45 34.34	5 03 51.07	14 55.51	54 46.624 13.043	U 15 06.6285 3910
15.5	66 47 38.46	-5 10 41.51	14 51.95	54 33.581 -10.572	L 15 19.0195 12.3921
16.0	72 47 22.64	-5 14 05.34	14 49.07	54 23.009	U 16 07.4116

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Aug. 16.0	72° 47' 22".64	-5° 14' 05".34	14' 49".07	54' 23".009 - 8".122	U 16 07.4116 ^h L 16 19.8048 ^h
16.5	78 45 19.39	5 14 04.13	14 46.86	54 14.887 5.728	L 16 19.8048 ^h U 17 08.1989 ^h
17.0	84 42 00.01	5 10 40.36	14 45.30	54 09.159 3.420	L 17 08.1989 ^h U 17 20.5935 ^h
17.5	90 37 54.20	5 03 57.46	14 44.37	54 05.739 - 1.217	L 17 20.5935 ^h U 18 08.9882 ^h
18.0	96 33 29.85	4 53 59.80	14 44.04	54 04.522 + 0.856	U 18 08.9882 ^h L 18 21.3824 ^h
18.5	102 29 12.92	-4 40 52.86	14 44.27	54 05.378 + 2.788	L 18 21.3824 ^h U 19 09.7758 ^h
19.0	108 25 27.27	4 24 43.27	14 45.03	54 08.166 4.567	U 19 09.7758 ^h L 19 22.1677 ^h
19.5	114 22 34.70	4 05 39.00	14 46.27	54 12.733 6.186	L 19 22.1677 ^h U 20 10.5580 ^h
20.0	120 20 54.89	3 43 49.51	14 47.96	54 18.919 7.642	U 20 10.5580 ^h L 20 22.9464 ^h
20.5	126 20 45.53	3 19 25.87	14 50.04	54 26.561 8.938	L 20 22.9464 ^h U 21 11.3327 ^h
21.0	132 22 22.39	-2 52 40.88	14 52.48	54 35.499 + 10.078	U 21 11.3327 ^h L 21 23.7170 ^h
21.5	138 25 59.50	2 23 49.20	14 55.22	54 45.577 11.071	L 21 23.7170 ^h ...
22.0	144 31 49.33	1 53 07.33	14 58.24	54 56.648 11.929	... U 22 12.0997 ^h
22.5	150 40 03.05	1 20 53.65	15 01.49	55 08.577 12.669	U 22 12.0997 ^h L 23 00.4812 ^h
23.0	156 50 50.78	0 47 28.33	15 04.94	55 21.246 13.304	L 23 00.4812 ^h U 23 12.8622 ^h
23.5	163 04 21.79	-0 13 13.25	15 08.56	55 34.550 + 13.854	U 23 12.8622 ^h L 24 01.2434 ^h
24.0	169 20 44.85	+0 21 28.22	15 12.34	55 48.404 14.335	L 24 01.2434 ^h U 24 13.6258 ^h
24.5	175 40 08.32	0 56 11.35	15 16.24	56 02.739 14.763	U 24 13.6258 ^h L 25 02.0105 ^h
25.0	182 02 40.44	1 30 30.40	15 20.27	56 17.502 15.149	L 25 02.0105 ^h U 25 14.3987 ^h
25.5	188 28 29.34	2 03 58.81	15 24.39	56 32.651 15.500	U 25 14.3987 ^h L 26 02.7917 ^h
26.0	194 57 43.16	+2 36 09.58	15 28.62	56 48.151 + 15.819	L 26 02.7917 ^h U 26 15.1906 ^h
26.5	201 30 29.90	3 06 35.54	15 32.93	57 03.970 16.103	U 26 15.1906 ^h L 27 03.5969 ^h
27.0	208 06 57.32	3 34 49.72	15 37.31	57 20.073 16.337	L 27 03.5969 ^h U 27 16.0118 ^h
27.5	214 47 12.60	4 00 25.70	15 41.76	57 36.410 16.505	U 27 16.0118 ^h L 28 04.4362 ^h
28.0	221 31 21.95	4 22 58.02	15 46.26	57 52.915 16.577	L 28 04.4362 ^h U 28 16.8710 ^h
28.5	228 19 30.13	+4 42 02.54	15 50.78	58 09.492 + 16.520	U 28 16.8710 ^h L 29 05.3168 ^h
29.0	235 11 39.80	4 57 16.97	15 55.28	58 26.012 16.293	L 29 05.3168 ^h U 29 17.7736 ^h
29.5	242 07 50.89	5 08 21.32	15 59.72	58 42.305 15.856	U 29 17.7736 ^h L 30 06.2411 ^h
30.0	249 07 59.82	5 14 58.53	16 04.04	58 58.161 15.159	L 30 06.2411 ^h U 30 18.7181 ^h
30.5	256 11 58.86	5 16 55.04	16 08.17	59 13.320 14.165	U 30 18.7181 ^h L 31 07.2033 ^h
31.0	263 19 35.45	+5 14 01.51	16 12.03	59 27.485 + 12.835	L 31 07.2033 ^h U 31 19.6945 ^h
Sept. 1.0	270 30 31.68	5 06 13.48	16 15.52	59 40.320 11.145	U 31 19.6945 ^h L 1 08.1891 ^h
1.5	277 44 23.99	4 53 31.99	16 18.56	59 51.465 9.084	L 1 08.1891 ^h U 1 20.6847 ^h
2.0	285 00 43.12	4 36 04.14	16 21.03	60 00.549 6.663	U 1 20.6847 ^h L 2 09.1783 ^h
2.5	292 18 54.27	4 14 03.43	16 22.85	60 07.212 3.910	L 2 09.1783 ^h U 2 21.6677 ^h
3.0	299 38 17.74	+3 47 49.88	16 23.92	60 11.122 + 0.878	U 2 21.6677 ^h L 3 10.1506 ^h
3.5	306 58 09.75	3 17 49.79	16 24.15	60 12.000 2.357	L 3 10.1506 ^h U 3 22.6255 ^h
4.0	314 17 43.62	2 44 35.20	16 23.51	60 09.643 5.702	U 3 22.6255 ^h L 4 11.0914 ^h
4.5	321 36 11.16	2 08 42.94	16 21.96	60 03.941 9.054	L 4 11.0914 ^h U 4 23.5478 ^h
5.0	328 52 44.26	1 30 53.44	16 19.49	59 54.887 12.299	U 4 23.5478 ^h L 5 11.9948 ^h
5.5	336 06 36.36	+0 51 49.25	16 16.14	59 42.588 - 15.328	L 5 11.9948 ^h ...
6.0	343 17 04.11	+0 12 13.47	16 11.97	59 27.260 18.041	... U 6 00.4328 ^h
6.5	350 23 28.57	-0 27 11.74	16 07.05	59 09.219 20.352	U 6 00.4328 ^h L 6 12.8624 ^h
7.0	357 25 16.46	1 05 46.57	16 01.51	58 48.867 22.198	L 6 12.8624 ^h U 7 01.2845 ^h
7.5	4 22 00.93	1 42 54.68	15 55.46	58 26.669 23.540	U 7 01.2845 ^h L 7 13.7003 ^h
8.0	11 13 22.11	-2 18 04.02	15 49.04	58 03.129 - 24.355	L 7 13.7003 ^h U 8 02.1107 ^h
8.5	17 59 07.35	-2 50 47.29	15 42.41	57 38.774	U 8 02.1107 ^h

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Sept. 8-0	17 59 07.35	-2 50 47.29	15 42.41	57 38.774	U 8 02.1107 ^{d h}
8-5	24 39 11.16	3 20 42.12	15 35.69	57 14.125	L 8 14.5167 ^h
9-0	31 13 34.94	3 47 30.89	15 29.03	56 49.683	U 9 02.9194
9-5	37 42 26.47	4 11 00.48	15 22.56	56 25.915	L 9 15.3197
10-0	44 05 59.36	4 31 01.75	15 16.38	56 03.244	U 10 03.7182
10-5	50 24 32.31	-4 47 28.97	15 10.61	55 42.040	L 10 16.1157
11-0	56 38 28.40	5 00 19.31	15 05.31	55 22.620	U 11 04.5126
11-5	62 48 14.35	5 09 32.27	15 00.58	55 05.244	L 11 16.9092
12-0	68 54 19.80	5 15 09.18	14 56.46	54 50.120	U 12 05.3057
12-5	74 57 16.60	5 17 12.79	14 53.00	54 37.405	L 12 17.7022
13-0	80 57 38.20	-5 15 46.99	14 50.22	54 27.203	U 13 06.0985
13-5	86 55 59.05	5 10 56.53	14 48.14	54 19.578	L 13 18.4946
14-0	92 52 54.06	5 02 46.89	14 46.77	54 14.549	U 14 06.8901
14-5	98 48 58.10	4 51 24.26	14 46.10	54 12.096	L 14 19.2848
15-0	104 44 45.55	4 36 55.50	14 46.12	54 12.163	U 15 07.6784
15-5	110 40 49.89	-4 19 28.26	14 46.80	54 14.661	L 15 20.0706
16-0	116 37 43.28	3 59 11.12	14 48.11	54 19.470	U 16 08.4614
16-5	122 35 56.28	3 36 13.74	14 50.01	54 26.439	L 16 20.8506
17-0	128 35 57.44	3 10 47.11	14 52.45	54 35.392	U 17 09.2383
17-5	134 38 13.03	2 43 03.74	14 55.37	54 46.130	L 17 21.6246
18-0	140 43 06.73	-2 13 17.88	14 58.72	54 58.432	U 18 10.0098
18-5	146 50 59.35	1 41 45.76	15 02.44	55 12.060	L 18 22.3943
19-0	153 02 08.66	1 08 45.66	15 06.44	55 26.765	U 19 10.7788
19-5	159 16 49.13	-0 34 38.08	15 10.67	55 42.291	L 19 23.1640
20-0	165 35 11.84	+0 00 14.33	15 15.06	55 58.382	U 20 11.5506
20-5	171 57 24.44	+0 35 26.84	15 19.53	56 14.784	L 20 23.9396
21-0	178 23 31.06	1 10 32.84	15 24.01	56 31.260	... ..
21-5	184 53 32.48	1 45 04.18	15 28.46	56 47.586	U 21 12.3321
22-0	191 27 26.21	2 18 31.62	15 32.82	57 03.565	L 22 00.7290
22-5	198 05 06.81	2 50 25.33	15 37.03	57 19.029	U 22 13.1314
23-0	204 46 26.11	+3 20 15.56	15 41.06	57 33.838	L 23 01.5404
23-5	211 31 13.66	3 47 33.28	15 44.89	57 47.885	U 23 13.9568
24-0	218 19 17.11	4 11 50.87	15 48.49	58 01.096	L 24 02.3817
24-5	225 10 22.64	4 32 42.80	15 51.85	58 13.422	U 24 14.8154
25-0	232 04 15.40	4 49 46.24	15 54.96	58 24.835	L 25 03.2583
25-5	239 00 39.88	+5 02 41.67	15 57.82	58 35.325	U 25 15.7104
26-0	245 59 20.26	5 11 13.34	16 00.42	58 44.887	L 26 04.1713
26-5	253 00 00.62	5 15 09.65	16 02.77	58 53.516	U 26 16.6399
27-0	260 02 25.16	5 14 23.50	16 04.86	59 01.197	L 27 05.1149
27-5	267 06 18.16	5 08 52.49	16 06.69	59 07.898	U 27 17.5947
28-0	274 11 23.95	+4 58 39.07	16 08.24	59 13.569	L 28 06.0771
28-5	281 17 26.78	4 43 50.60	16 09.48	59 18.133	U 28 18.5600
29-0	288 24 10.52	4 24 39.35	16 10.39	59 21.490	L 29 07.0412
29-5	295 31 18.47	4 01 22.37	16 10.95	59 23.520	U 29 19.5188
30-0	302 38 33.05	3 34 21.34	16 11.10	59 24.085	L 30 07.9910
30-5	309 45 35.54	+3 04 02.21	16 10.82	59 23.044	U 30 20.4566
Oct. 1-0	316 52 05.95	+2 30 54.78	16 10.06	59 20.256	L 1 08.9148

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Oct. 1-0	316° 52' 05".95	+2° 30' 54".78	16' 10".06	59' 20".256 - 4.656	L 1 08-9148 ^h 12.4505
1-5	323 57 42.89	1 55 32.12	16 08.79	59 15.600 6.621	U 1 21.3653 4426
2-0	331 02 03.69	1 18 29.83	16 06.98	59 08.979 8.637	L 2 09-8079 4353
2-5	338 04 44.57	0 40 25.18	16 04.63	59 00.342 10.657	U 2 22.2432 4284
3-0	345 05 21.03	+0 01 56.17	16 01.73	58 49.685 12.622	L 3 10-6716 4224
3-5	352 03 28.32	-0 36 19.45	15 58.29	58 37.063 -14.471	U 3 23-0940 12.4173
4-0	358 58 42.13	1 13 45.23	15 54.35	58 22.592 16.140	L 4 11.5113 4130
4-5	5 50 39.23	1 49 46.93	15 49.95	58 06.452 17.576	U 4 23-9243 4097
5-0	12 38 58.30	2 23 53.33	15 45.16	57 48.876 18.727	... ..
5-5	19 23 20.66	2 55 36.89	15 40.06	57 30.149 19.552	L 5 12.3340 4073
6-0	26 03 30.96	-3 24 34.18	15 34.73	57 10.597 -20.027	U 6 00.7413 12.4055
6-5	32 39 17.81	3 50 26.06	15 29.28	56 50.570 20.131	L 6 13.1468 4043
7-0	39 10 34.24	4 12 57.77	15 23.79	56 30.439 19.865	U 7 01.5511 4036
7-5	45 37 18.03	4 31 58.67	15 18.38	56 10.574 19.234	L 7 13.9547 4033
8-0	51 59 31.84	4 47 21.97	15 13.14	55 51.340 18.253	U 8 02.3580 4029
8-5	58 17 23.29	-4 59 04.27	15 08.17	55 33.087 -16.948	L 8 14.7609 12.4027
9-0	64 31 04.79	5 07 05.12	15 03.55	55 16.139 15.349	U 9 03.1636 4023
9-5	70 40 53.30	5 11 26.50	14 59.37	55 00.790 13.488	L 9 15.5659 4015
10-0	76 47 09.99	5 12 12.33	14 55.69	54 47.302 11.403	U 10 03.9674 4006
10-5	82 50 19.83	5 09 28.08	14 52.59	54 35.899 9.130	L 10 16.3680 3992
11-0	88 50 51.14	-5 03 20.38	14 50.10	54 26.769 -6.709	U 11 04.7672 12.3975
11-5	94 49 15.10	4 53 56.73	14 48.27	54 20.060 4.177	L 11 17.1647 3954
12-0	100 46 05.25	4 41 25.29	14 47.13	54 15.883 -1.574	U 12 05.5601 3932
12-5	106 41 56.99	4 25 54.80	14 46.70	54 14.309 +1.063	L 12 17.9533 3909
13-0	112 37 27.06	4 07 34.50	14 46.99	54 15.372 3.695	U 13 06.3442 3885
13-5	118 33 13.05	-3 46 34.18	14 48.00	54 19.067 +6.281	L 13 18.7327 12.3862
14-0	124 29 52.87	3 23 04.33	14 49.71	54 25.348 8.783	U 14 07.1189 3844
14-5	130 28 04.20	2 57 16.23	14 52.10	54 34.131 11.161	L 14 19.5033 3829
15-0	136 28 23.95	2 29 22.24	14 55.14	54 45.292 13.373	U 15 07.8862 3820
15-5	142 31 27.69	1 59 36.03	14 58.79	54 58.665 15.379	L 15 20.2682 3820
16-0	148 37 48.97	-1 28 12.85	15 02.98	55 14.044 +17.135	U 16 08.6502 12.3826
16-5	154 47 58.69	0 55 29.80	15 07.65	55 31.179 18.603	L 16 21.0328 3844
17-0	161 02 24.37	-0 21 46.11	15 12.71	55 49.782 19.749	U 17 09.4172 3872
17-5	167 21 29.43	+0 12 36.72	15 18.09	56 09.531 20.535	L 17 21.8044 3912
18-0	173 45 32.46	0 47 14.80	15 23.69	56 30.066 20.941	U 18 10.1956 3962
18-5	180 14 46.55	+1 21 41.87	15 29.39	56 51.007 +20.948	L 18 22.5918 12.4025
19-0	186 49 18.59	1 55 29.48	15 35.10	57 11.955 20.552	U 19 10.9943 4100
19-5	193 29 08.84	2 28 07.39	15 40.70	57 32.507 19.759	L 19 23.4043 4185
20-0	200 14 10.56	2 59 04.10	15 46.08	57 52.266 18.594	U 20 11.8228 4277
20-5	207 04 09.97	3 27 47.60	15 51.15	58 10.860 17.093	... ..
21-0	213 58 46.44	+3 53 46.35	15 55.81	58 27.953 +15.304	L 21 00.2505 12.4378
21-5	220 57 33.04	4 16 30.23	15 59.98	58 43.257 13.289	U 21 12.6883 4479
22-0	227 59 57.44	4 35 31.74	16 03.60	58 56.546 11.115	L 22 01.1362 4580
22-5	235 05 23.07	4 50 26.94	16 06.63	59 07.661 8.856	U 22 13.5942 4675
23-0	242 13 10.54	5 00 56.49	16 09.04	59 16.517 6.579	L 23 02.0617 4757
23-5	249 22 39.19	+5 06 46.35	16 10.83	59 23.096 +4.352	U 23 14.5374 12.4822
24-0	256 33 08.73	+5 07 48.29	16 12.02	59 27.448	L 24 03.0196

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Oct. 24.0	256° 33' 08".73	+5° 07' 48".29	16' 12".02	59' 27".448 + 2".226	L 24 03.0196 ^{d h} 12.4866 ^h
24.5	263 44 00.70	5 04 00.11	16 12.62	59 29.674 + 0.246	U 24 15.5062 .4886
25.0	270 54 39.78	4 55 25.63	16 12.69	59 29.920 - 1.561	L 25 03.9948 .4879
25.5	278 04 34.75	4 42 14.38	16 12.26	59 28.359 3.182	U 25 16.4827 .4850
26.0	285 13 19.16	4 24 41.11	16 11.40	59 25.177 4.615	L 26 04.9677 .4796
26.5	292 20 31.52	+4 03 05.24	16 10.14	59 20.562 - 5.875	U 26 17.4473 12.4726
27.0	299 25 55.26	3 37 50.13	16 08.54	59 14.687 6.978	L 27 05.9199 .4644
27.5	306 29 18.29	3 09 22.40	16 06.64	59 07.709 7.954	U 27 18.3843 .4553
28.0	313 30 32.36	2 38 11.27	16 04.47	58 59.755 8.827	L 28 06.8396 .4462
28.5	320 29 32.26	2 04 47.87	16 02.07	58 50.928 9.629	U 28 19.2858 .4372
29.0	327 26 14.93	+1 29 44.65	15 59.44	58 41.299 -10.380	L 29 07.7230 12.4290
29.5	334 20 38.53	0 53 34.81	15 56.62	58 30.919 11.103	U 29 20.1520 .4215
30.0	341 12 41.65	+0 16 51.76	15 53.59	58 19.816 11.808	L 30 08.5735 .4151
30.5	348 02 22.55	-0 19 51.43	15 50.37	58 08.008 12.498	U 30 20.9886 .4100
31.0	354 49 38.66	0 56 02.51	15 46.97	57 55.510 13.170	L 31 09.3986 .4060
Nov. 31.5	1 34 26.22	-1 31 10.60	15 43.38	57 42.340 -13.812	U 31 21.8046 12.4032
1.0	8 16 40.10	2 04 46.63	15 39.62	57 28.528 14.405	L 1 10.2078 .4014
1.5	14 56 13.88	2 36 23.84	15 35.69	57 14.123 14.926	U 1 22.6092 .4006
2.0	21 33 00.06	3 05 38.19	15 31.63	56 59.197 15.348	L 2 11.0098 .4006
2.5	28 06 50.55	3 32 08.68	15 27.44	56 43.849 15.641	U 2 23.4104 .4011
3.0	34 37 37.12	-3 55 37.65	15 23.18	56 28.208 -15.778	L 3 11.8115 12.4019
3.5	41 05 12.12	4 15 50.93	15 18.88	56 12.430 15.733	... ..
4.0	47 29 29.10	4 32 37.85	15 14.60	55 56.697 15.485	U 4 00.2134 .4031
4.5	53 50 23.49	4 45 51.23	15 10.38	55 41.212 15.014	L 4 12.6165 .4040
5.0	60 07 53.25	4 55 27.16	15 06.29	55 26.198 14.311	U 5 01.0205 .4048
5.5	66 21 59.36	-5 01 24.77	15 02.39	55 11.887 -13.368	L 5 13.4253 12.4050
6.0	72 32 46.26	5 03 45.89	14 58.75	54 58.519 12.187	U 6 01.8303 .4047
6.5	78 40 22.19	5 02 34.68	14 55.43	54 46.332 10.772	L 6 14.2350 .4037
7.0	84 44 59.32	4 57 57.26	14 52.49	54 35.560 9.133	U 7 02.6387 .4020
7.5	90 46 53.81	4 50 01.33	14 50.00	54 26.427 7.285	L 7 15.0407 .3997
8.0	96 46 25.80	-4 38 55.82	14 48.02	54 19.142 - 5.248	U 8 03.4404 12.3969
8.5	102 43 59.18	4 24 50.63	14 46.59	54 13.894 3.042	L 8 15.8373 .3935
9.0	108 40 01.41	4 07 56.37	14 45.76	54 10.852 - 0.694	U 9 04.2308 .3901
9.5	114 35 03.22	3 48 24.19	14 45.57	54 10.158 + 1.772	L 9 16.6209 .3865
10.0	120 29 38.24	3 26 25.72	14 46.05	54 11.930 4.320	U 10 05.0074 .3831
10.5	126 24 22.61	-3 02 13.02	14 47.23	54 16.250 + 6.920	L 10 17.3905 12.3801
11.0	132 19 54.53	2 35 58.67	14 49.12	54 23.170 9.535	U 11 05.7706 .3777
11.5	138 16 53.76	2 07 55.82	14 51.71	54 32.705 12.122	L 11 18.1483 .3761
12.0	144 16 01.04	1 38 18.45	14 55.02	54 44.827 14.639	U 12 06.5244 .3755
12.5	150 17 57.49	1 07 21.55	14 59.01	54 59.466 17.034	L 12 18.8999 .3759
13.0	156 23 23.87	-0 35 21.37	15 03.65	55 16.500 +19.257	U 13 07.2758 12.3777
13.5	162 32 59.75	-0 02 35.74	15 08.89	55 35.757 21.247	L 13 19.6535 .3807
14.0	168 47 22.58	+0 30 35.65	15 14.68	55 57.004 22.947	U 14 08.0342 .3853
14.5	175 07 06.58	1 03 51.05	15 20.93	56 19.951 24.295	L 14 20.4195 .3915
15.0	181 32 41.63	1 36 46.44	15 27.55	56 44.246 25.229	U 15 08.8110 .3990
15.5	188 04 31.92	+2 08 55.49	15 34.43	57 09.475 +25.694	L 15 21.2100 12.4081
16.0	194 42 54.67	+2 39 49.68	15 41.43	57 35.169	U 16 09.6181

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Nov. 16.0	194 42 54.67	+2 39 49.68	15 41.43	57 35.169	U 16 09.6181 ^d 12.4187 ^h
16.5	201 27 58.80	3 08 58.59	15 48.41	58 00.809 +25.640	L 16 22.0368
17.0	208 19 43.76	3 35 50.52	15 55.23	58 25.842 25.033	U 17 10.4671
17.5	215 17 58.58	3 59 53.29	16 01.73	58 49.697 23.855	L 17 22.9101
18.0	222 22 21.33	4 20 35.34	16 07.75	59 11.805 22.108	U 18 11.3661
				19.824	4689
18.5	229 32 19.13	+4 37 27.08	16 13.16	59 31.629	L 18 23.8350
19.0	236 47 08.74	4 50 02.27	16 17.80	59 48.685 +17.056	12.4810
19.5	244 05 57.93	4 57 59.50	16 21.59	60 02.573 13.888	U 19 12.3160
20.0	251 27 47.39	5 01 03.43	16 24.43	60 12.998 10.425	L 20 00.8076
20.5	258 51 33.30	4 59 05.87	16 26.27	60 19.782 6.784	U 20 13.3074
				+ 3.094	5051
21.0	266 16 10.21	+4 52 06.27	16 27.12	60 22.876	L 21 01.8125
21.5	273 40 33.99	4 40 11.89	16 26.98	60 22.359 - 0.517	12.5070
22.0	281 03 44.61	4 23 37.38	16 25.90	60 18.423 3.936	U 21 14.3195
22.5	288 24 48.49	4 02 43.97	16 23.98	60 11.358 7.065	L 22 02.8250
23.0	295 43 00.23	3 37 58.39	16 21.30	60 01.529 9.829	U 22 15.3255
				12.183	5005
23.5	302 57 43.63	+3 09 51.49	16 17.98	59 49.346	L 23 03.8183
24.0	310 08 32.01	2 38 57.01	16 14.14	59 35.242 -14.104	12.4714
24.5	317 15 07.91	2 05 50.23	16 09.89	59 19.646 15.596	U 23 16.3010
25.0	324 17 22.29	1 31 06.89	16 05.35	59 02.964 16.682	L 24 04.7724
25.5	331 15 13.36	0 55 22.32	16 00.61	58 45.567 17.397	U 24 17.2316
				17.791	4592
26.0	338 08 45.19	+0 19 10.71	15 55.76	58 27.776 -17.915	L 25 05.6788
26.5	344 58 06.31	-0 16 55.35	15 50.88	58 09.861 17.821	U 25 18.1145
27.0	351 43 28.17	0 52 25.26	15 46.02	57 52.040 17.563	L 26 06.5397
27.5	358 25 03.96	1 26 50.53	15 41.24	57 34.477 17.184	U 26 18.9557
28.0	5 03 07.38	1 59 45.01	15 36.56	57 17.293 16.725	L 27 07.3640
					4022
28.5	11 37 51.73	-2 30 44.90	15 32.00	57 00.568 -16.216	U 27 19.7662
29.0	18 09 29.20	2 59 28.86	15 27.58	56 44.352 15.678	L 28 08.1637
29.5	24 38 10.36	3 25 38.07	15 23.31	56 28.674 15.126	U 28 20.5582
30.0	31 04 03.90	3 48 56.25	15 19.19	56 13.548 14.566	L 29 08.9509
30.5	37 27 16.54	4 09 09.75	15 15.22	55 58.982 13.998	U 29 21.3431
					3928
Dec. 1.0	43 47 53.17	-4 26 07.61	15 11.41	55 44.984 -13.412	L 30 09.7359
1.5	50 05 57.12	4 39 41.52	15 07.75	55 31.572 12.798	U 30 22.1299
2.0	56 21 30.58	4 49 45.92	15 04.27	55 18.774 12.140	L 1 10.5257
2.5	62 34 35.12	4 56 17.87	15 00.96	55 06.634 11.420	U 1 22.9237
3.0	68 45 12.30	4 59 17.02	14 57.85	54 55.214 10.621	L 2 11.3238
					4020
3.5	74 53 24.25	-4 58 45.46	14 54.95	54 44.593 - 9.721	U 2 23.7258
4.0	80 59 14.28	4 54 47.55	14 52.31	54 34.872 8.707	L 3 12.1291
4.5	87 02 47.47	4 47 29.68	14 49.93	54 26.165 7.559	U 4 00.5330
5.0	93 04 11.14	4 37 00.05	14 47.87	54 18.606 6.270	L 4 12.9368
5.5	99 03 35.30	4 23 28.40	14 46.17	54 12.336 4.830	U 5 01.3394
					4006
6.0	105 01 12.96	-4 07 05.74	14 44.85	54 07.506 - 3.233	L 5 13.7400
6.5	110 57 20.40	3 48 04.13	14 43.97	54 04.273 - 1.482	U 6 02.1377
7.0	116 52 17.21	3 26 36.44	14 43.57	54 02.791 + 0.423	L 6 14.5318
7.5	122 46 26.45	3 02 56.18	14 43.68	54 03.214 2.471	U 7 02.9219
8.0	128 40 14.53	2 37 17.39	14 44.35	54 05.685 4.649	L 7 15.3076
					3815
8.5	134 34 11.08	-2 09 54.56	14 45.62	54 10.334 + 6.942	U 8 03.6891
9.0	140 28 48.79	-1 41 02.60	14 47.51	54 17.276	L 8 16.0664
					12.3739
					U 9 04.4403

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Dec. 9.0	140° 28' 48".79	-1° 41' 02".60	14' 47".51	54' 17".276	U 9 04.4403 ^d 12.3710 ^h
9.5	146 24 43.04	1 10 56.92	14 50.05	54 26.601 + 9.325	L 9 16.8113 .3691
10.0	152 22 31.64	0 39 53.50	14 53.26	54 38.373 11.772	U 10 05.1804 .3686
10.5	158 22 54.23	-0 08 09.04	14 57.14	54 52.620 14.247	L 10 17.5490 .3691
11.0	164 26 31.83	+0 23 58.79	15 01.69	55 09.331 16.711	U 11 05.9181 .3714
11.5	170 34 06.03	+0 56 11.19	15 06.90	55 28.449 19.118	L 11 18.2895 12.3751
12.0	176 46 18.21	1 28 07.97	15 12.74	55 49.860 + 21.411	U 12 06.6646 .3805
12.5	183 03 48.47	1 59 27.33	15 19.15	56 13.388 23.528	L 12 19.0451 .3879
13.0	189 27 14.44	2 29 45.72	15 26.07	56 38.791 25.403	U 13 07.4330 .3970
13.5	195 57 09.87	2 58 37.73	15 33.41	57 05.747 26.956	L 13 19.8300 .4079
14.0	202 34 03.08	+3 25 36.21	15 41.07	57 33.857 28.110	U 14 08.2379 12.4204
14.5	209 18 15.23	3 50 12.47	15 48.91	58 02.641 + 28.784	L 14 20.6583 .4344
15.0	216 09 58.51	4 11 56.82	15 56.78	58 31.540 28.899	U 15 09.0927 .4494
15.5	223 09 14.50	4 30 19.34	16 04.52	58 59.929 28.389	L 15 21.5421 .4649
16.0	230 15 52.58	4 44 50.93	16 11.93	59 27.128 27.199	U 16 10.0070 .4803
16.5	237 29 28.94	+4 55 04.69	16 18.82	59 52.431 25.303	L 16 22.4873 12.4945
17.0	244 49 26.14	5 00 37.49	16 25.01	60 15.133 + 22.702	U 17 10.9818 .5066
17.5	252 14 53.45	5 01 11.54	16 30.30	60 34.567 19.434	L 17 23.4884 .5159
18.0	259 44 48.23	4 56 35.96	16 34.55	60 50.146 15.579	... ..
18.5	267 17 58.18	4 46 48.08	16 37.61	61 01.400 11.254	U 18 12.0043 .5212
19.0	274 53 04.45	+4 31 54.10	16 39.41	61 08.009 6.609	L 19 00.5255 12.5224
19.5	282 28 45.32	4 12 09.34	16 39.91	61 09.821 + 1.812	U 19 13.0479 .5194
20.0	290 03 40.05	3 47 57.65	16 39.10	61 06.871 - 2.950	L 20 01.5673 .5124
20.5	297 36 32.65	3 19 50.28	16 37.06	60 59.365 7.506	U 20 14.0797 .5023
21.0	305 06 14.99	2 48 24.25	16 33.87	60 47.667 11.698	L 21 02.5820 .4898
21.5	312 31 49.27	+2 14 20.42	16 29.68	60 32.267 15.400	U 21 15.0718 12.4760
22.0	319 52 29.43	1 38 21.54	16 24.63	60 13.745 - 18.522	L 22 03.5478 .4620
22.5	327 07 41.69	1 01 10.43	16 18.90	59 52.728 21.017	U 22 16.0098 .4481
23.0	334 17 04.25	+0 23 28.45	16 12.67	59 29.860 22.868	L 23 04.4579 .4352
23.5	341 20 26.38	-0 14 05.63	16 06.11	59 05.760 24.100	U 23 16.8931 .4238
24.0	348 17 47.01	-0 50 56.42	15 59.36	58 41.004 - 24.898	L 24 05.3169 12.4139
24.5	355 09 13.12	1 26 32.28	15 52.58	58 16.106 24.600	U 24 17.7308 .4057
25.0	1 54 57.98	2 00 25.48	15 45.88	57 51.506 23.939	L 25 06.1365 .3993
25.5	8 35 19.50	2 32 12.11	15 39.36	57 27.567 22.992	U 25 18.5358 .3946
26.0	15 10 38.69	3 01 31.85	15 33.09	57 04.575 21.829	L 26 06.9304 .3916
26.5	21 41 18.32	-3 28 07.71	15 27.14	56 42.746 - 20.516	U 26 19.3220 12.3898
27.0	28 07 41.75	3 51 45.70	15 21.55	56 22.230 19.107	L 27 07.7118 .3894
27.5	34 30 12.03	4 12 14.54	15 16.35	56 03.123 17.650	U 27 20.1012 .3901
28.0	40 49 11.22	4 29 25.48	15 11.54	55 45.473 16.180	L 28 08.4913 .3914
28.5	47 04 59.82	4 43 12.02	15 07.13	55 29.293 14.728	U 28 20.8827 .3933
29.0	53 17 56.53	-4 53 29.83	15 03.12	55 14.565 - 13.309	L 29 09.2760 12.3955
29.5	59 28 18.07	5 00 16.59	14 59.49	55 01.256 11.938	U 29 21.6715 .3976
30.0	65 36 19.22	5 03 31.96	14 56.24	54 49.318 10.616	L 30 10.0691 .3993
30.5	71 42 12.94	5 03 17.50	14 53.35	54 38.702 9.344	U 30 22.4684 .4005
31.0	77 46 10.61	4 59 36.62	14 50.80	54 29.358 8.114	L 31 10.8689 .4009
31.5	83 48 22.41	-4 52 34.54	14 48.59	54 21.244 - 6.914	U 31 23.2698 12.4005
32.0	89 48 57.70	-4 42 18.21	14 46.71	54 14.330	L 32 11.6703

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 1			January 3		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	20 46 41.544 ^s 146.528	-14 05 10.88 ^s +456.02	0	22 37 34.186 ^s 130.819	-6 51 44.63 ^s +601.28
1	20 49 08.072 ^s 146.186	13 57 34.86 ^s 460.90	1	22 39 45.005 ^s 130.536	6 41 43.35 ^s 602.53
2	20 51 34.258 ^s 145.845	13 49 53.96 ^s 465.70	2	22 41 55.541 ^s 130.257	6 31 40.82 ^s 603.71
3	20 54 00.103 ^s 145.503	13 42 08.26 ^s 470.43	3	22 44 05.798 ^s 129.980	6 21 37.11 ^s 604.85
4	20 56 25.606 ^s 145.159	13 34 17.83 ^s 475.06	4	22 46 15.778 ^s 129.706	6 11 32.26 ^s 605.90
5	20 58 50.765 ^s 144.815	13 26 22.77 ^s 479.61	5	22 48 25.484 ^s 129.435	6 01 26.36 ^s 606.92
6	21 01 15.580 ^s 144.471	13 18 23.16 ^s 484.09	6	22 50 34.919 ^s 129.167	5 51 19.44 ^s 607.85
7	21 03 40.051 ^s 144.125	13 10 19.07 ^s 488.48	7	22 52 44.086 ^s 128.901	5 41 11.59 ^s 608.74
8	21 06 04.176 ^s 143.781	13 02 10.59 ^s 492.79	8	22 54 52.987 ^s 128.639	5 31 02.85 ^s 609.56
9	21 08 27.957 ^s 143.435	12 53 57.80 ^s 497.01	9	22 57 01.626 ^s 128.380	5 20 53.29 ^s 610.32
10	21 10 51.392 ^s 143.090	12 45 40.79 ^s 501.15	10	22 59 10.006 ^s 128.123	5 10 42.97 ^s 611.03
11	21 13 14.482 ^s 142.745	12 37 19.64 ^s 505.22	11	23 01 18.129 ^s 127.870	5 00 31.94 ^s 611.68
12	21 15 37.227 ^s 142.400	12 28 54.42 ^s 509.19	12	23 03 25.999 ^s 127.619	4 50 20.26 ^s 612.27
13	21 17 59.627 ^s 142.055	12 20 25.23 ^s 513.10	13	23 05 33.618 ^s 127.372	4 40 07.99 ^s 612.80
14	21 20 21.682 ^s 141.710	12 11 52.13 ^s 516.91	14	23 07 40.990 ^s 127.128	4 29 55.19 ^s 613.28
15	21 22 43.392 ^s 141.367	12 03 15.22 ^s 520.65	15	23 09 48.118 ^s 126.887	4 19 41.91 ^s 613.70
16	21 25 04.759 ^s 141.023	11 54 34.57 ^s 524.30	16	23 11 55.005 ^s 126.649	4 09 28.21 ^s 614.07
17	21 27 25.782 ^s 140.680	11 45 50.27 ^s 527.88	17	23 14 01.654 ^s 126.414	3 59 14.14 ^s 614.39
18	21 29 46.462 ^s 140.338	11 37 02.39 ^s 531.38	18	23 16 08.068 ^s 126.182	3 48 59.75 ^s 614.65
19	21 32 06.800 ^s 139.997	11 28 11.01 ^s 534.79	19	23 18 14.250 ^s 125.953	3 38 45.10 ^s 614.85
20	21 34 26.797 ^s 139.657	11 19 16.22 ^s 538.13	20	23 20 20.203 ^s 125.729	3 28 30.25 ^s 615.01
21	21 36 46.454 ^s 139.318	11 10 18.09 ^s 541.38	21	23 22 25.932 ^s 125.506	3 18 15.24 ^s 615.11
22	21 39 05.772 ^s 138.980	11 01 16.71 ^s 544.57	22	23 24 31.438 ^s 125.287	3 08 00.13 ^s 615.16
23	21 41 24.752 ^s 138.643	-10 52 12.14 ^s +547.67	23	23 26 36.725 ^s 125.071	-2 57 44.97 ^s +615.16
January 2			January 4		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	21 43 43.395 ^s 138.308	-10 43 04.47 ^s +550.69	0	23 28 41.796 ^s 124.858	-2 47 29.81 ^s +615.12
1	21 46 01.703 ^s 137.973	10 33 53.78 ^s 553.64	1	23 30 46.654 ^s 124.650	2 37 14.69 ^s 615.01
2	21 48 19.676 ^s 137.641	10 24 40.14 ^s 556.50	2	23 32 51.304 ^s 124.443	2 26 59.68 ^s 614.87
3	21 50 37.317 ^s 137.309	10 15 23.64 ^s 559.30	3	23 34 55.747 ^s 124.240	2 16 44.81 ^s 614.67
4	21 52 54.626 ^s 136.980	10 06 04.34 ^s 562.02	4	23 36 59.987 ^s 124.040	2 06 30.14 ^s 614.42
5	21 55 11.606 ^s 136.651	9 56 42.32 ^s 564.66	5	23 39 04.027 ^s 123.844	1 56 15.72 ^s 614.13
6	21 57 28.257 ^s 136.326	9 47 17.66 ^s 567.23	6	23 41 07.871 ^s 123.651	1 46 01.59 ^s 613.79
7	21 59 44.583 ^s 136.001	9 37 50.43 ^s 569.72	7	23 43 11.522 ^s 123.461	1 35 47.80 ^s 613.41
8	22 02 00.584 ^s 135.678	9 28 20.71 ^s 572.14	8	23 45 14.983 ^s 123.275	1 25 34.39 ^s 612.97
9	22 04 16.262 ^s 135.358	9 18 48.57 ^s 574.48	9	23 47 18.258 ^s 123.091	1 15 21.42 ^s 612.50
10	22 06 31.620 ^s 135.040	9 09 14.09 ^s 576.76	10	23 49 21.349 ^s 122.911	1 05 08.92 ^s 611.97
11	22 08 46.660 ^s 134.722	8 59 37.33 ^s 578.96	11	23 51 24.260 ^s 122.733	0 54 56.95 ^s 611.40
12	22 11 01.382 ^s 134.408	8 49 58.37 ^s 581.09	12	23 53 26.993 ^s 122.561	0 44 45.55 ^s 610.79
13	22 13 15.790 ^s 134.096	8 40 17.28 ^s 583.15	13	23 55 29.554 ^s 122.390	0 34 34.76 ^s 610.14
14	22 15 29.886 ^s 133.786	8 30 34.13 ^s 585.14	14	23 57 31.944 ^s 122.222	0 24 24.62 ^s 609.44
15	22 17 43.672 ^s 133.479	8 20 48.99 ^s 587.05	15	23 59 34.166 ^s 122.059	0 14 15.18 ^s 608.69
16	22 19 57.151 ^s 133.172	8 11 01.94 ^s 588.90	16	0 01 36.225 ^s 121.899	-0 04 06.49 ^s 607.91
17	22 22 10.323 ^s 132.870	8 01 13.04 ^s 590.69	17	0 03 38.124 ^s 121.741	+0 06 01.42 ^s 607.09
18	22 24 23.193 ^s 132.569	7 51 22.35 ^s 592.40	18	0 05 39.865 ^s 121.586	0 16 08.51 ^s 606.22
19	22 26 35.762 ^s 132.271	7 41 29.95 ^s 594.04	19	0 07 41.451 ^s 121.436	0 26 14.73 ^s 605.31
20	22 28 48.033 ^s 131.975	7 31 35.91 ^s 595.62	20	0 09 42.887 ^s 121.288	0 36 20.04 ^s 604.36
21	22 31 00.008 ^s 131.682	7 21 40.29 ^s 597.13	21	0 11 44.175 ^s 121.144	0 46 24.40 ^s 603.37
22	22 33 11.690 ^s 131.392	7 11 43.16 ^s 598.57	22	0 13 45.319 ^s 121.002	0 56 27.77 ^s 602.34
23	22 35 23.082 ^s 131.104	7 01 44.59 ^s +599.96	23	0 15 46.321 ^s 120.865	1 06 30.11 ^s +601.27
24	22 37 34.186 ^s	-6 51 44.63 ^s	24	0 17 47.186 ^s	+1 16 31.38 ^s

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 5			January 7		
h	h m s	° ' " s	h	h m s	° ' " s
0	0 17 47.186	+ 1 16 31.38	0	1 52 45.964	+ 8 45 05.03
1	0 19 47.915	1 26 31.55	1	1 54 43.706	8 53 32.11
2	0 21 48.513	1 36 30.57	2	1 56 41.450	9 01 56.52
3	0 23 48.982	1 46 28.41	3	1 58 39.200	9 10 18.22
4	0 25 49.326	1 56 25.02	4	2 00 36.957	9 18 37.18
5	0 27 49.547	2 06 20.37	5	2 02 34.724	9 26 53.39
6	0 29 49.650	2 16 14.43	6	2 04 32.502	9 35 06.81
7	0 31 49.637	2 26 07.15	7	2 06 30.295	9 43 17.41
8	0 33 49.511	2 35 58.51	8	2 08 28.104	9 51 25.17
9	0 35 49.275	2 45 48.45	9	2 10 25.931	9 59 30.07
10	0 37 48.933	2 55 36.96	10	2 12 23.778	10 07 32.07
11	0 39 48.487	3 05 23.98	11	2 14 21.648	10 15 31.14
12	0 41 47.941	3 15 09.50	12	2 16 19.542	10 23 27.27
13	0 43 47.297	3 24 53.46	13	2 18 17.462	10 31 20.43
14	0 45 46.559	3 34 35.85	14	2 20 15.411	10 39 10.58
15	0 47 45.730	3 44 16.62	15	2 22 13.391	10 46 57.70
16	0 49 44.813	3 53 55.73	16	2 24 11.403	10 54 41.77
17	0 51 43.810	4 03 33.16	17	2 26 09.449	11 02 22.77
18	0 53 42.725	4 13 08.88	18	2 28 07.531	11 10 00.65
19	0 55 41.560	4 22 42.84	19	2 30 05.651	11 17 35.40
20	0 57 40.320	4 32 15.02	20	2 32 03.810	11 25 07.00
21	0 59 39.006	4 41 45.38	21	2 34 02.011	11 32 35.41
22	1 01 37.621	4 51 13.89	22	2 36 00.255	11 40 00.61
23	1 03 36.168	+ 5 00 40.53	23	2 37 58.545	+ 11 47 22.57
	118.483	+ 564.71		118.335	+ 438.71
January 6			January 8		
0	1 05 34.651	+ 5 10 05.24	0	2 39 56.880	+ 11 54 41.28
1	1 07 33.072	5 19 28.02	1	2 41 55.264	12 01 56.69
2	1 09 31.434	5 28 48.81	2	2 43 53.698	12 09 08.80
3	1 11 29.740	5 38 07.60	3	2 45 52.184	12 16 17.56
4	1 13 27.993	5 47 24.35	4	2 47 50.722	12 23 22.96
5	1 15 26.194	5 56 39.03	5	2 49 49.315	12 30 24.98
6	1 17 24.348	6 05 51.61	6	2 51 47.963	12 37 23.58
7	1 19 22.457	6 15 02.06	7	2 53 46.669	12 44 18.74
8	1 21 20.524	6 24 10.35	8	2 55 45.434	12 51 10.44
9	1 23 18.550	6 33 16.44	9	2 57 44.260	12 57 58.64
10	1 25 16.540	6 42 20.32	10	2 59 43.147	13 04 43.34
11	1 27 14.496	6 51 21.94	11	3 01 42.096	13 11 24.49
12	1 29 12.419	7 00 21.29	12	3 03 41.110	13 18 02.08
13	1 31 10.314	7 09 18.32	13	3 05 40.190	13 24 36.09
14	1 33 08.182	7 18 13.02	14	3 07 39.336	13 31 06.48
15	1 35 06.027	7 27 05.35	15	3 09 38.550	13 37 33.23
16	1 37 03.850	7 35 55.28	16	3 11 37.832	13 43 56.32
17	1 39 01.654	7 44 42.79	17	3 13 37.185	13 50 15.72
18	1 40 59.442	7 53 27.84	18	3 15 36.610	13 56 31.41
19	1 42 57.216	8 02 10.41	19	3 17 36.106	14 02 43.37
20	1 44 54.978	8 10 50.47	20	3 19 35.675	14 08 51.56
21	1 46 52.732	8 19 27.99	21	3 21 35.319	14 14 55.97
22	1 48 50.479	8 28 02.94	22	3 23 35.038	14 20 56.58
23	1 50 48.222	8 36 35.30	23	3 25 34.833	14 26 53.35
24	1 52 45.964	+ 8 45 05.03	24	3 27 34.705	+ 14 32 46.27
	117.742	+ 509.73		119.872	+ 352.92

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 9			January 11		
h	h m s	° ' " +"	h	h m s	° ' " +"
0	3 27 34.705 ^s _{119.949}	+14 32 46.27 ^s _{+349.04}	0	5 05 06.716 ^s _{123.934}	+17 52 15.07 ^s _{+137.51}
1	3 29 34.654 _{120.028}	14 38 35.31 _{345.13}	1	5 07 10.650 _{124.008}	17 54 32.58 _{132.64}
2	3 31 34.682 _{120.107}	14 44 20.44 _{341.21}	2	5 09 14.658 _{124.081}	17 56 45.22 _{127.78}
3	3 33 34.789 _{120.188}	14 50 01.65 _{337.26}	3	5 11 18.739 _{124.152}	17 58 53.00 _{122.88}
4	3 35 34.977 _{120.267}	14 55 38.91 _{333.29}	4	5 13 22.891 _{124.224}	18 00 55.88 _{117.98}
5	3 37 35.244 _{120.350}	15 01 12.20 _{329.29}	5	5 15 27.115 _{124.293}	18 02 53.86 _{113.07}
6	3 39 35.594 _{120.431}	15 06 41.49 _{325.27}	6	5 17 31.408 _{124.362}	18 04 46.93 _{108.14}
7	3 41 36.025 _{120.513}	15 12 06.76 _{321.22}	7	5 19 35.770 _{124.430}	18 06 35.07 _{103.20}
8	3 43 36.538 _{120.597}	15 17 27.98 _{317.17}	8	5 21 40.200 _{124.497}	18 08 18.27 _{98.24}
9	3 45 37.135 _{120.680}	15 22 45.15 _{313.07}	9	5 23 44.697 _{124.562}	18 09 56.51 _{93.27}
10	3 47 37.815 _{120.764}	15 27 58.22 _{308.96}	10	5 25 49.259 _{124.627}	18 11 29.78 _{88.30}
11	3 49 38.579 _{120.848}	15 33 07.18 _{304.83}	11	5 27 53.886 _{124.689}	18 12 58.08 _{83.31}
12	3 51 39.427 _{120.933}	15 38 12.01 _{300.67}	12	5 29 58.575 _{124.752}	18 14 21.39 _{78.31}
13	3 53 40.360 _{121.019}	15 43 12.68 _{296.49}	13	5 32 03.327 _{124.813}	18 15 39.70 _{73.29}
14	3 55 41.379 _{121.103}	15 48 09.17 _{292.29}	14	5 34 08.140 _{124.872}	18 16 52.99 _{68.28}
15	3 57 42.482 _{121.190}	15 53 01.46 _{288.07}	15	5 36 13.012 _{124.930}	18 18 01.27 _{63.24}
16	3 59 43.672 _{121.275}	15 57 49.53 _{283.83}	16	5 38 17.942 _{124.988}	18 19 04.51 _{58.20}
17	4 01 44.947 _{121.362}	16 02 33.36 _{279.56}	17	5 40 22.930 _{125.043}	18 20 02.71 _{53.15}
18	4 03 46.309 _{121.448}	16 07 12.92 _{275.27}	18	5 42 27.973 _{125.098}	18 20 55.86 _{48.08}
19	4 05 47.757 _{121.534}	16 11 48.19 _{270.96}	19	5 44 33.071 _{125.151}	18 21 43.94 _{43.02}
20	4 07 49.291 _{121.621}	16 16 19.15 _{266.63}	20	5 46 38.222 _{125.203}	18 22 26.96 _{37.94}
21	4 09 50.912 _{121.707}	16 20 45.78 _{262.28}	21	5 48 43.425 _{125.253}	18 23 04.90 _{32.86}
22	4 11 52.619 _{121.794}	16 25 08.06 _{257.91}	22	5 50 48.678 _{125.302}	18 23 37.76 _{27.76}
23	4 13 54.413 _{121.881}	+16 29 25.97 _{+253.51}	23	5 52 53.980 _{125.350}	+18 24 05.52 _{+22.66}
January 10			January 12		
h	h m s	° ' " +"	h	h m s	° ' " +"
0	4 15 56.294 _{121.967}	+16 33 39.48 _{+249.10}	0	5 54 59.330 _{125.395}	+18 24 28.18 _{+17.56}
1	4 17 58.261 _{122.054}	16 37 48.58 _{244.66}	1	5 57 04.725 _{125.441}	18 24 45.74 _{12.44}
2	4 20 00.315 _{122.139}	16 41 53.24 _{240.21}	2	5 59 10.166 _{125.484}	18 24 58.18 _{7.33}
3	4 22 02.454 _{122.226}	16 45 53.45 _{235.73}	3	6 01 15.650 _{125.526}	18 25 05.51 _{+2.20}
4	4 24 04.680 _{122.312}	16 49 49.18 _{231.24}	4	6 03 21.176 _{125.566}	18 25 07.71 _{-2.93}
5	4 26 06.992 _{122.398}	16 53 40.42 _{226.72}	5	6 05 26.742 _{125.605}	18 25 04.78 _{8.06}
6	4 28 09.390 _{122.483}	16 57 27.14 _{222.20}	6	6 07 32.347 _{125.642}	18 24 56.72 _{13.20}
7	4 30 11.873 _{122.568}	17 01 09.34 _{217.63}	7	6 09 37.989 _{125.678}	18 24 43.52 _{18.34}
8	4 32 14.441 _{122.652}	17 04 46.97 _{213.07}	8	6 11 43.667 _{125.712}	18 24 25.18 _{23.49}
9	4 34 17.093 _{122.738}	17 08 20.04 _{208.47}	9	6 13 49.379 _{125.746}	18 24 01.69 _{28.64}
10	4 36 19.831 _{122.821}	17 11 48.51 _{203.87}	10	6 15 55.125 _{125.776}	18 23 33.05 _{33.78}
11	4 38 22.652 _{122.904}	17 15 12.38 _{199.23}	11	6 18 00.901 _{125.807}	18 22 59.27 _{38.94}
12	4 40 25.556 _{122.988}	17 18 31.61 _{194.59}	12	6 20 06.708 _{125.834}	18 22 20.33 _{44.10}
13	4 42 28.544 _{123.070}	17 21 46.29 _{189.93}	13	6 22 12.542 _{125.861}	18 21 36.23 _{49.25}
14	4 44 31.614 _{123.152}	17 24 56.13 _{185.24}	14	6 24 18.403 _{125.886}	18 20 46.98 _{54.41}
15	4 46 34.766 _{123.234}	17 28 01.37 _{180.54}	15	6 26 24.289 _{125.910}	18 19 52.57 _{59.57}
16	4 48 38.000 _{123.314}	17 31 01.91 _{175.83}	16	6 28 30.199 _{125.932}	18 18 53.00 _{64.72}
17	4 50 41.314 _{123.394}	17 33 57.74 _{171.09}	17	6 30 36.131 _{125.952}	18 17 48.28 _{69.88}
18	4 52 44.708 _{123.474}	17 36 48.83 _{166.35}	18	6 32 42.083 _{125.971}	18 16 38.40 _{75.04}
19	4 54 48.182 _{123.553}	17 39 35.18 _{161.57}	19	6 34 48.054 _{125.988}	18 15 23.36 _{80.19}
20	4 56 51.735 _{123.630}	17 42 16.75 _{156.80}	20	6 36 54.042 _{126.005}	18 14 03.17 _{85.35}
21	4 58 55.365 _{123.708}	17 44 53.55 _{151.99}	21	6 39 00.047 _{126.018}	18 12 37.82 _{90.49}
22	5 00 59.073 _{123.784}	17 47 25.54 _{147.17}	22	6 41 06.065 _{126.031}	18 11 07.33 _{95.64}
23	5 03 02.857 _{123.859}	17 49 52.72 _{+142.35}	23	6 43 12.096 _{126.042}	18 09 31.69 _{-100.79}
24	5 05 06.716	+17 52 15.07	24	6 45 18.138	+18 07 50.90

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination	Hour	Apparent Right Ascension			Apparent Declination
January 13					January 15				
h	h	m	s		h	h	m	s	
0	6 45	18.138		+18 07 50.90	0	8 25	53.698		+15 09 16.54
1	6 47	24.189	126.051	18 06 04.97	1	8 27	58.667	124.969	15 03 36.78
2	6 49	30.248	126.059	18 04 13.90	2	8 30	03.590	124.923	14 57 52.60
3	6 51	36.314	126.066	18 02 17.71	3	8 32	08.468	124.878	14 52 04.01
4	6 53	42.385	126.071	18 00 16.38	4	8 34	13.300	124.832	14 46 11.04
5	6 55	48.459	126.074	17 58 09.93	5	8 36	18.085	124.785	14 40 13.72
6	6 57	54.535	126.076	17 55 58.37	6	8 38	22.824	124.739	14 34 12.07
7	7 00	00.612	126.077	17 53 41.69	7	8 40	27.515	124.691	14 28 06.12
8	7 02	06.687	126.075	17 51 19.91	8	8 42	32.160	124.645	14 21 55.89
9	7 04	12.760	126.073	17 48 53.04	9	8 44	36.757	124.597	14 15 41.42
10	7 06	18.828	126.068	17 46 21.08	10	8 46	41.307	124.550	14 09 22.72
11	7 08	24.891	126.063	17 43 44.03	11	8 48	45.809	124.502	14 02 59.83
12	7 10	30.948	126.057	17 41 01.92	12	8 50	50.263	124.454	13 56 32.77
13	7 12	36.995	126.047	17 38 14.74	13	8 52	54.669	124.406	13 50 01.57
14	7 14	43.033	126.038	17 35 22.51	14	8 54	59.028	124.359	13 43 26.26
15	7 16	49.060	126.027	17 32 25.24	15	8 57	03.338	124.310	13 36 46.87
16	7 18	55.074	126.014	17 29 22.93	16	8 59	07.601	124.263	13 30 03.43
17	7 21	01.074	126.000	17 26 15.60	17	9 01	11.817	124.216	13 23 15.95
18	7 23	07.059	125.985	17 23 03.26	18	9 03	15.984	124.167	13 16 24.49
19	7 25	13.027	125.968	17 19 45.92	19	9 05	20.105	124.121	13 09 29.06
20	7 27	18.977	125.950	17 16 23.59	20	9 07	24.178	124.073	13 02 29.69
21	7 29	24.908	125.931	17 12 56.29	21	9 09	28.205	124.027	12 55 26.42
22	7 31	30.818	125.910	17 09 24.03	22	9 11	32.185	123.980	12 48 19.28
23	7 33	36.707	125.889	+17 05 46.82	23	9 13	36.119	123.934	+12 41 08.29
			125.865	-222.14				123.887	-434.80
January 14					January 16				
0	7 35	42.572	125.841	+17 02 04.68	0	9 15	40.006	123.843	+12 33 53.49
1	7 37	48.413	125.816	16 58 17.61	1	9 17	43.849	123.797	12 26 34.90
2	7 39	54.229	125.790	16 54 25.64	2	9 19	47.646	123.753	12 19 12.57
3	7 42	00.019	125.761	16 50 28.79	3	9 21	51.399	123.709	12 11 46.52
4	7 44	05.780	125.733	16 46 27.05	4	9 23	55.108	123.665	12 04 16.79
5	7 46	11.513	125.703	16 42 20.46	5	9 25	58.773	123.623	11 56 43.40
6	7 48	17.216	125.672	16 38 09.03	6	9 28	02.396	123.580	11 49 06.39
7	7 50	22.888	125.640	16 33 52.77	7	9 30	05.976	123.539	11 41 25.80
8	7 52	28.528	125.607	16 29 31.71	8	9 32	09.515	123.498	11 33 41.65
9	7 54	34.135	125.573	16 25 05.85	9	9 34	13.013	123.458	11 25 53.97
10	7 56	39.708	125.538	16 20 35.23	10	9 36	16.471	123.419	11 18 02.82
11	7 58	45.246	125.503	16 15 59.85	11	9 38	19.890	123.381	11 10 08.21
12	8 00	50.749	125.466	16 11 19.73	12	9 40	23.271	123.342	11 02 10.18
13	8 02	56.215	125.428	16 06 34.90	13	9 42	26.613	123.306	10 54 08.76
14	8 05	01.643	125.390	16 01 45.38	14	9 44	29.919	123.271	10 46 04.00
15	8 07	07.033	125.351	15 56 51.18	15	9 46	33.190	123.235	10 37 55.92
16	8 09	12.384	125.311	15 51 52.33	16	9 48	36.425	123.202	10 29 44.56
17	8 11	17.695	125.270	15 46 48.84	17	9 50	39.627	123.169	10 21 29.95
18	8 13	22.965	125.229	15 41 40.74	18	9 52	42.796	123.138	10 13 12.13
19	8 15	28.194	125.187	15 36 28.06	19	9 54	45.934	123.107	10 04 51.14
20	8 17	33.381	125.145	15 31 10.80	20	9 56	49.041	123.077	9 56 27.02
21	8 19	38.526	125.101	15 25 48.99	21	9 58	52.118	123.050	9 47 59.79
22	8 21	43.627	125.058	15 20 22.67	22	10 00	55.168	123.023	9 39 29.49
23	8 23	48.685	125.013	15 14 51.84	23	10 02	58.191	122.997	9 30 56.17
24	8 25	53.698		+15 09 16.54	24	10 05	01.188		+ 9 22 19.85

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 17			January 19		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	10 05 01.188	+ 9 22 19.85	0	11 43 27.921	+ 1 43 24.01
1	10 07 04.161	9 13 40.58	1	11 45 31.878	1 33 09.93
2	10 09 07.110	9 04 58.39	2	11 47 35.910	1 22 54.94
3	10 11 10.039	8 56 13.31	3	11 49 40.022	1 12 39.08
4	10 13 12.947	8 47 25.40	4	11 51 44.215	1 02 22.39
5	10 15 15.836	8 38 34.68	5	11 53 48.493	0 52 04.92
6	10 17 18.708	8 29 41.19	6	11 55 52.858	0 41 46.73
7	10 19 21.564	8 20 44.97	7	11 57 57.312	0 31 27.84
8	10 21 24.406	8 11 46.05	8	12 00 01.859	0 21 08.33
9	10 23 27.236	8 02 44.49	9	12 02 06.501	0 10 48.22
10	10 25 30.054	7 53 40.31	10	12 04 11.241	+ 0 00 27.58
11	10 27 32.863	7 44 33.55	11	12 06 16.082	- 0 09 53.55
12	10 29 35.664	7 35 24.25	12	12 08 21.026	0 20 15.13
13	10 31 38.459	7 26 12.46	13	12 10 26.076	0 30 37.10
14	10 33 41.250	7 16 58.21	14	12 12 31.235	0 40 59.42
15	10 35 44.038	7 07 41.54	15	12 14 36.506	0 51 22.03
16	10 37 46.826	6 58 22.49	16	12 16 41.891	1 01 44.89
17	10 39 49.614	6 49 01.11	17	12 18 47.394	1 12 07.95
18	10 41 52.406	6 39 37.42	18	12 20 53.017	1 22 31.15
19	10 43 55.203	6 30 11.47	19	12 22 58.763	1 32 54.44
20	10 45 58.006	6 20 43.31	20	12 25 04.635	1 43 17.78
21	10 48 00.818	6 11 12.97	21	12 27 10.636	1 53 41.12
22	10 50 03.641	6 01 40.49	22	12 29 16.768	2 04 04.40
23	10 52 06.477	+ 5 52 05.91	23	12 31 23.035	- 2 14 27.57
	122.973	-519.27		126.403	-623.01
	122.949	522.19			
	122.929	525.08			
	122.908	527.91			
	122.889	530.72			
	122.872	533.49			
	122.856	536.22			
	122.842	538.92			
	122.830	541.56			
	122.818	544.18			
	122.809	546.76			
	122.801	549.30			
	122.795	551.79			
	122.791	554.25			
	122.788	556.67			
	122.788	559.05			
	122.788	561.38			
	122.792	563.69			
	122.797	565.95			
	122.803	568.16			
	122.812	570.34			
	122.823	572.48			
	122.836	574.58			
	122.850	-576.63			
January 18			January 20		
0	10 54 09.327	+ 5 42 29.28	0	12 33 29.438	- 2 24 50.58
1	10 56 12.194	5 32 50.64	1	12 35 35.982	2 35 13.38
2	10 58 15.080	5 23 10.02	2	12 37 42.669	2 45 35.91
3	11 00 17.987	5 13 27.48	3	12 39 49.501	2 55 58.13
4	11 02 20.918	5 03 43.04	4	12 41 56.482	3 06 19.97
5	11 04 23.873	4 53 56.76	5	12 44 03.615	3 16 41.39
6	11 06 26.857	4 44 08.68	6	12 46 10.902	3 27 02.34
7	11 08 29.870	4 34 18.83	7	12 48 18.346	3 37 22.76
8	11 10 32.915	4 24 27.27	8	12 50 25.950	3 47 42.59
9	11 12 35.994	4 14 34.03	9	12 52 33.717	3 58 01.78
10	11 14 39.110	4 04 39.16	10	12 54 41.649	4 08 20.28
11	11 16 42.265	3 54 42.69	11	12 56 49.750	4 18 38.03
12	11 18 45.462	3 44 44.68	12	12 58 58.023	4 28 54.98
13	11 20 48.701	3 34 45.17	13	13 01 06.469	4 39 11.07
14	11 22 51.987	3 24 44.20	14	13 03 15.093	4 49 26.24
15	11 24 55.322	3 14 41.81	15	13 05 23.896	4 59 40.44
16	11 26 58.707	3 04 38.06	16	13 07 32.881	5 09 53.62
17	11 29 02.146	2 54 32.97	17	13 09 42.052	5 20 05.71
18	11 31 05.640	2 44 26.61	18	13 11 51.411	5 30 16.65
19	11 33 09.193	2 34 19.01	19	13 14 00.964	5 40 26.40
20	11 35 12.807	2 24 10.21	20	13 16 10.704	5 50 34.89
21	11 37 16.484	2 14 00.26	21	13 18 20.643	6 00 42.07
22	11 39 20.227	2 03 49.22	22	13 20 30.781	6 10 47.87
23	11 41 24.039	1 53 37.12	23	13 22 41.120	6 20 52.24
24	11 43 27.921	+ 1 43 24.01	24	13 24 51.664	- 6 30 55.12
	123.882	-613.11			
	123.812	612.10			
	123.743	611.04			
	123.677	609.95			
	123.614	608.79			
	123.553	607.61			
	123.494	606.36			
	123.439	605.09			
	123.385	603.75			
	123.335	602.39			
	123.286	600.97			
	123.239	599.51			
	123.197	598.01			
	123.155	596.47			
	123.116	594.87			
	123.079	593.24			
	123.045	591.56			
	123.013	589.85			
	122.984	588.08			
	122.955	586.28			
	122.931	584.44			
	122.907	582.54			
	122.886	580.62			
	122.867	578.64			

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 21			January 23		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	13 24 51.664	130.751	0	15 14 01.544	143.026
1	13 27 02.415	130.960	1	15 16 24.570	143.309
2	13 29 13.375	131.172	2	15 18 47.879	143.589
3	13 31 24.547	131.386	3	15 21 11.468	143.871
4	13 33 35.933	131.604	4	15 23 35.339	144.151
5	13 35 47.537	131.823	5	15 25 59.490	144.432
6	13 37 59.360	132.046	6	15 28 23.922	144.711
7	13 40 11.406	132.270	7	15 30 48.633	144.989
8	13 42 23.676	132.496	8	15 33 13.622	145.268
9	13 44 36.172	132.727	9	15 35 38.890	145.544
10	13 46 48.899	132.958	10	15 38 04.434	145.821
11	13 49 01.857	133.192	11	15 40 30.255	146.095
12	13 51 15.049	133.428	12	15 42 56.350	146.369
13	13 53 28.477	133.667	13	15 45 22.719	146.642
14	13 55 42.144	133.907	14	15 47 49.361	146.912
15	13 57 56.051	134.151	15	15 50 16.273	147.182
16	14 00 10.202	134.395	16	15 52 43.455	147.449
17	14 02 24.597	134.643	17	15 55 10.904	147.715
18	14 04 39.240	134.892	18	15 57 38.619	147.979
19	14 06 54.132	135.143	19	16 00 06.598	148.242
20	14 09 09.275	135.396	20	16 02 34.840	148.501
21	14 11 24.671	135.651	21	16 05 03.341	148.759
22	14 13 40.322	135.908	22	16 07 32.100	149.014
23	14 15 56.230	136.166	23	16 10 01.114	149.268
January 22			January 24		
0	14 18 12.396	136.427	0	16 12 30.382	149.518
1	14 20 28.823	136.689	1	16 14 59.900	149.765
2	14 22 45.512	136.952	2	16 17 29.665	150.011
3	14 25 02.464	137.218	3	16 19 59.676	150.253
4	14 27 19.682	137.484	4	16 22 29.929	150.492
5	14 29 37.166	137.752	5	16 25 00.421	150.728
6	14 31 54.918	138.022	6	16 27 31.149	150.961
7	14 34 12.940	138.293	7	16 30 02.110	151.190
8	14 36 31.233	138.565	8	16 32 33.300	151.416
9	14 38 49.798	138.838	9	16 35 04.716	151.639
10	14 41 08.636	139.112	10	16 37 36.355	151.858
11	14 43 27.748	139.388	11	16 40 08.213	152.073
12	14 45 47.136	139.664	12	16 42 40.286	152.284
13	14 48 06.800	139.942	13	16 45 12.570	152.491
14	14 50 26.742	140.219	14	16 47 45.061	152.694
15	14 52 46.961	140.499	15	16 50 17.755	152.894
16	14 55 07.460	140.777	16	16 52 50.649	153.088
17	14 57 28.237	141.058	17	16 55 23.737	153.278
18	14 59 49.295	141.338	18	16 57 57.015	153.465
19	15 02 10.633	141.619	19	17 00 30.480	153.645
20	15 04 32.252	141.901	20	17 03 04.125	153.822
21	15 06 54.153	142.182	21	17 05 37.947	153.994
22	15 09 16.335	142.463	22	17 08 11.941	154.160
23	15 11 38.798	142.746	23	17 10 46.101	154.322
24	15 14 01.544		24	17 13 20.423	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination			
January 25							January 27							
h	h	m	s	°	'	"	h	h	m	s	°	'	"	
0	17	13	20.423	154.480	-17	55 32.13	0	19	18	05.477	155.054	-17	28 34.91	+224.56
1	17	15	54.903	154.631	17	58 02.21	1	19	20	40.531	154.917	17	24 50.35	231.97
2	17	18	29.534	154.777	18	00 24.75	2	19	23	15.448	154.774	17	20 58.38	239.35
3	17	21	04.311	154.919	18	02 39.69	3	19	25	50.222	154.627	17	16 59.03	246.68
4	17	23	39.230	155.054	18	04 47.02	4	19	28	24.849	154.474	17	12 52.35	253.99
5	17	26	14.284	155.185	18	06 46.69	5	19	30	59.323	154.315	17	08 38.39	261.20
6	17	28	49.469	155.310	18	08 38.68	6	19	33	33.638	154.153	17	04 17.19	268.39
7	17	31	24.779	155.429	18	10 22.95	7	19	36	07.791	153.983	16	59 48.80	275.52
8	17	34	00.208	155.542	18	11 59.49	8	19	38	41.774	153.810	16	55 13.28	282.62
9	17	36	35.750	155.650	18	13 28.26	9	19	41	15.584	153.632	16	50 30.66	289.64
10	17	39	11.400	155.753	18	14 49.24	10	19	43	49.216	153.448	16	45 41.02	296.63
11	17	41	47.153	155.848	18	16 02.40	11	19	46	22.664	153.260	16	40 44.39	303.55
12	17	44	23.001	155.939	18	17 07.73	12	19	48	55.924	153.068	16	35 40.84	310.41
13	17	46	58.940	156.023	18	18 05.20	13	19	51	28.992	152.870	16	30 30.43	317.23
14	17	49	34.963	156.101	18	18 54.79	14	19	54	01.862	152.669	16	25 13.20	323.98
15	17	52	11.064	156.173	18	19 36.50	15	19	56	34.531	152.462	16	19 49.22	330.67
16	17	54	47.237	156.240	18	20 10.30	16	19	59	06.993	152.253	16	14 18.55	337.30
17	17	57	23.477	156.299	18	20 36.18	17	20	01	39.246	152.038	16	08 41.25	343.87
18	17	59	59.776	156.354	18	20 54.12	18	20	04	11.284	151.819	16	02 57.38	350.37
19	18	02	36.130	156.401	18	21 04.13	19	20	06	43.103	151.597	15	57 07.01	356.81
20	18	05	12.531	156.442	18	21 06.19	20	20	09	14.700	151.371	15	51 10.20	363.19
21	18	07	48.973	156.477	18	21 00.28	21	20	11	46.071	151.149	15	45 07.01	369.49
22	18	10	25.450	156.505	18	20 46.42	22	20	14	17.211	150.907	15	38 57.52	375.73
23	18	13	01.955	156.529	-18	20 24.59	23	20	16	48.118	150.670	-15	32 41.79	+381.91
January 26							January 28							
0	18	15	38.484	156.544	-18	19 54.79	0	20	19	18.788	150.430	-15	26 19.88	+388.01
1	18	18	15.028	156.554	18	19 17.03	1	20	21	49.218	150.186	15	19 51.87	394.05
2	18	20	51.582	156.557	18	18 31.30	2	20	24	19.404	149.938	15	13 17.82	400.00
3	18	23	28.139	156.555	18	17 37.61	3	20	26	49.342	149.689	15	06 37.82	405.90
4	18	26	04.694	156.545	18	16 35.95	4	20	29	19.031	149.435	14	59 51.92	411.72
5	18	28	41.239	156.529	18	15 26.35	5	20	31	48.466	149.179	14	53 00.20	417.46
6	18	31	17.768	156.507	18	14 08.81	6	20	34	17.645	148.921	14	46 02.74	423.14
7	18	33	54.275	156.479	18	12 43.33	7	20	36	46.566	148.660	14	38 59.60	428.73
8	18	36	30.754	156.444	18	11 09.94	8	20	39	15.226	148.395	14	31 50.87	434.26
9	18	39	07.198	156.403	18	09 28.64	9	20	41	43.621	148.129	14	24 36.61	439.70
10	18	41	43.601	156.356	18	07 39.45	10	20	44	11.750	147.861	14	17 16.91	445.08
11	18	44	19.957	156.302	18	05 42.38	11	20	46	39.611	147.590	14	09 51.83	450.37
12	18	46	56.259	156.243	18	03 37.46	12	20	49	07.201	147.317	14	02 21.46	455.59
13	18	49	32.502	156.176	18	01 24.71	13	20	51	34.518	147.042	13	54 45.87	460.73
14	18	52	08.678	156.104	17	59 04.14	14	20	54	01.560	146.765	13	47 05.14	465.79
15	18	54	44.782	156.026	17	56 35.79	15	20	56	28.325	146.487	13	39 19.35	470.78
16	18	57	20.808	155.942	17	53 59.67	16	20	58	54.812	146.207	13	31 28.57	475.69
17	18	59	56.750	155.851	17	51 15.82	17	21	01	21.019	145.924	13	23 32.88	480.51
18	19	02	32.601	155.755	17	48 24.26	18	21	03	46.943	145.642	13	15 32.37	485.26
19	19	05	08.356	155.652	17	45 25.03	19	21	06	12.585	145.357	13	07 27.11	489.92
20	19	07	44.008	155.544	17	42 18.15	20	21	08	37.942	145.071	12	59 17.19	494.52
21	19	10	19.552	155.430	17	39 03.66	21	21	11	03.013	144.785	12	51 02.67	499.02
22	19	12	54.982	155.311	17	35 41.60	22	21	13	27.798	144.496	12	42 43.65	503.45
23	19	15	30.293	155.184	17	32 12.00	23	21	15	52.294	144.207	12	34 20.20	+507.80
24	19	18	05.477		-17	28 34.91	24	21	18	16.501		-12	25 52.40	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
January 29							January 31						
h	m	s	°	'	"		h	m	s	°	'	"	
0	21	18	16.501	143.918	-12	25 52.40	0	23	08	02.020	130.634	-4	40 19.20
1	21	20	40.419	143.627	12	17 20.33	1	23	10	12.654	130.396	4	29 54.02
2	21	23	04.046	143.336	12	08 44.08	2	23	12	23.050	130.161	4	19 28.25
3	21	25	27.382	143.044	12	00 03.72	3	23	14	33.211	129.928	4	09 01.95
4	21	27	50.426	142.752	11	51 19.34	4	23	16	43.139	129.697	3	58 35.18
5	21	30	13.178	142.460	11	42 31.01	5	23	18	52.836	129.469	3	48 08.01
6	21	32	35.638	142.167	11	33 38.82	6	23	21	02.305	129.243	3	37 40.49
7	21	34	57.805	141.873	11	24 42.84	7	23	23	11.548	129.020	3	27 12.69
8	21	37	19.678	141.581	11	15 43.17	8	23	25	20.568	128.799	3	16 44.67
9	21	39	41.259	141.288	11	06 39.87	9	23	27	29.367	128.581	3	06 16.49
10	21	42	02.547	140.995	10	57 33.03	10	23	29	37.948	128.365	2	55 48.20
11	21	44	23.542	140.702	10	48 22.73	11	23	31	46.313	128.153	2	45 19.87
12	21	46	44.244	140.409	10	39 09.05	12	23	33	54.466	127.941	2	34 51.56
13	21	49	04.653	140.118	10	29 52.07	13	23	36	02.407	127.734	2	24 23.31
14	21	51	24.771	139.825	10	20 31.87	14	23	38	10.141	127.528	2	13 55.20
15	21	53	44.596	139.534	10	11 08.53	15	23	40	17.669	127.325	2	03 27.28
16	21	56	04.130	139.244	10	01 42.13	16	23	42	24.994	127.126	1	52 59.59
17	21	58	23.374	138.954	9	52 12.75	17	23	44	32.120	126.928	1	42 32.20
18	22	00	42.328	138.664	9	42 40.46	18	23	46	39.048	126.733	1	32 05.17
19	22	03	00.992	138.376	9	33 05.36	19	23	48	45.781	126.541	1	21 38.54
20	22	05	19.368	138.088	9	23 27.50	20	23	50	52.322	126.352	1	11 12.37
21	22	07	37.456	137.801	9	13 46.98	21	23	52	58.674	126.165	1	00 46.71
22	22	09	55.257	137.516	9	04 03.87	22	23	55	04.839	125.981	0	50 21.62
23	22	12	12.773	137.231	-8	54 18.24	23	23	57	10.820	125.800	-	0 39 57.15
January 30							February 1						
0	22	14	30.004	136.948	-8	44 30.18	0	23	59	16.620	125.621	-	0 29 33.34
1	22	16	46.952	136.666	8	34 39.77	1	0	01	22.241	125.446	0	19 10.26
2	22	19	03.618	136.384	8	24 47.07	2	0	03	27.687	125.272	-	0 08 47.94
3	22	21	20.002	136.105	8	14 52.17	3	0	05	32.959	125.102	+	0 01 33.56
4	22	23	36.107	135.827	8	04 55.13	4	0	07	38.061	124.935	0	11 54.19
5	22	25	51.934	135.550	7	54 56.04	5	0	09	42.996	124.769	0	22 13.90
6	22	28	07.484	135.275	7	44 54.97	6	0	11	47.765	124.608	0	32 32.64
7	22	30	22.759	135.000	7	34 51.99	7	0	13	52.373	124.448	0	42 50.38
8	22	32	37.759	134.729	7	24 47.18	8	0	15	56.821	124.292	0	53 07.05
9	22	34	52.488	134.459	7	14 40.61	9	0	18	01.113	124.138	1	03 22.62
10	22	37	06.947	134.190	7	04 32.36	10	0	20	05.251	124.138	1	13 37.03
11	22	39	21.137	133.923	6	54 22.48	11	0	22	09.238	123.987	1	23 50.25
12	22	41	35.060	133.657	6	44 11.07	12	0	24	13.077	123.839	1	34 02.23
13	22	43	48.717	133.395	6	33 58.19	13	0	26	16.770	123.693	1	44 12.91
14	22	46	02.112	133.133	6	23 43.90	14	0	28	20.321	123.551	1	54 22.27
15	22	48	15.245	132.874	6	13 28.29	15	0	30	23.731	123.410	2	04 30.25
16	22	50	28.119	132.617	6	03 11.41	16	0	32	27.004	123.273	2	14 36.82
17	22	52	40.736	132.361	5	52 53.34	17	0	34	30.143	123.139	2	24 41.92
18	22	54	53.097	132.108	5	42 34.15	18	0	36	33.150	123.007	2	34 45.52
19	22	57	05.205	131.856	5	32 13.91	19	0	38	36.028	122.878	2	44 47.58
20	22	59	17.061	131.608	5	21 52.67	20	0	40	38.780	122.752	2	54 48.05
21	23	01	28.669	131.361	5	11 30.52	21	0	42	41.408	122.628	3	04 46.90
22	23	03	40.030	131.116	5	01 07.51	22	0	44	43.916	122.508	3	14 44.08
23	23	05	51.146	130.874	4	50 43.72	23	0	46	46.305	122.389	3	24 39.55
24	23	08	02.020		-4	40 19.20	24	0	48	48.579	122.274	+	3 34 33.28

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 2			February 4		
h	h m s	° ' " "	h	h m s	° ' " "
0	0 48 48.579 ^s 122.162	+ 3 34 33.28 ^s +591.94	0	2 25 12.540 ^s 119.698	+10 44 01.82 ^s +467.47
1	0 50 50.741 ^s 122.051	3 44 25.22 ^s 590.13	1	2 27 12.238 ^s 119.701	10 51 49.29 ^s 464.18
2	0 52 52.792 ^s 121.945	3 54 15.35 ^s 588.26	2	2 29 11.939 ^s 119.706	10 59 33.47 ^s 460.87
3	0 54 54.737 ^s 121.840	4 04 03.61 ^s 586.36	3	2 31 11.645 ^s 119.712	11 07 14.34 ^s 457.54
4	0 56 56.577 ^s 121.738	4 13 49.97 ^s 584.43	4	2 33 11.357 ^s 119.722	11 14 51.88 ^s 454.17
5	0 58 58.315 ^s 121.638	4 23 34.40 ^s 582.45	5	2 35 11.079 ^s 119.732	11 22 26.05 ^s 450.79
6	1 00 59.953 ^s 121.543	4 33 16.85 ^s 580.45	6	2 37 10.811 ^s 119.744	11 29 56.84 ^s 447.39
7	1 03 01.496 ^s 121.448	4 42 57.30 ^s 578.40	7	2 39 10.555 ^s 119.759	11 37 24.23 ^s 443.95
8	1 05 02.944 ^s 121.357	4 52 35.70 ^s 576.32	8	2 41 10.314 ^s 119.774	11 44 48.18 ^s 440.49
9	1 07 04.301 ^s 121.268	5 02 12.02 ^s 574.20	9	2 43 10.088 ^s 119.792	11 52 08.67 ^s 437.02
10	1 09 05.569 ^s 121.183	5 11 46.22 ^s 572.05	10	2 45 09.880 ^s 119.811	11 59 25.69 ^s 433.51
11	1 11 06.752 ^s 121.098	5 21 18.27 ^s 569.87	11	2 47 09.691 ^s 119.832	12 06 39.20 ^s 429.99
12	1 13 07.850 ^s 121.018	5 30 48.14 ^s 567.64	12	2 49 09.523 ^s 119.855	12 13 49.19 ^s 426.44
13	1 15 08.868 ^s 120.940	5 40 15.78 ^s 565.40	13	2 51 09.378 ^s 119.879	12 20 55.63 ^s 422.86
14	1 17 09.808 ^s 120.864	5 49 41.18 ^s 563.10	14	2 53 09.257 ^s 119.904	12 27 58.49 ^s 419.27
15	1 19 10.672 ^s 120.790	5 59 04.28 ^s 560.79	15	2 55 09.161 ^s 119.932	12 34 57.76 ^s 415.66
16	1 21 11.462 ^s 120.721	6 08 25.07 ^s 558.43	16	2 57 09.093 ^s 119.960	12 41 53.42 ^s 412.02
17	1 23 12.183 ^s 120.651	6 17 43.50 ^s 556.04	17	2 59 09.053 ^s 119.991	12 48 45.44 ^s 408.35
18	1 25 12.834 ^s 120.587	6 26 59.54 ^s 553.63	18	3 01 09.044 ^s 120.023	12 55 33.79 ^s 404.67
19	1 27 13.421 ^s 120.523	6 36 13.17 ^s 551.18	19	3 03 09.067 ^s 120.056	13 02 18.46 ^s 400.96
20	1 29 13.944 ^s 120.462	6 45 24.35 ^s 548.69	20	3 05 09.123 ^s 120.090	13 08 59.42 ^s 397.23
21	1 31 14.406 ^s 120.405	6 54 33.04 ^s 546.18	21	3 07 09.213 ^s 120.127	13 15 36.65 ^s 393.48
22	1 33 14.811 ^s 120.348	7 03 39.22 ^s 543.64	22	3 09 09.340 ^s 120.164	13 22 10.13 ^s 389.71
23	1 35 15.159 ^s 120.295	+ 7 12 42.86 ^s +541.06	23	3 11 09.504 ^s 120.203	+13 28 39.84 ^s +385.92
February 3			February 5		
0	1 37 15.454 ^s 120.245	+ 7 21 43.92 ^s +538.46	0	3 13 09.707 ^s 120.243	+13 35 05.76 ^s +382.10
1	1 39 15.699 ^s 120.195	7 30 42.38 ^s 535.82	1	3 15 09.950 ^s 120.285	13 41 27.86 ^s 378.26
2	1 41 15.894 ^s 120.150	7 39 38.20 ^s 533.16	2	3 17 10.235 ^s 120.327	13 47 46.12 ^s 374.41
3	1 43 16.044 ^s 120.106	7 48 31.36 ^s 530.46	3	3 19 10.562 ^s 120.371	13 54 00.53 ^s 370.52
4	1 45 16.150 ^s 120.064	7 57 21.82 ^s 527.74	4	3 21 10.933 ^s 120.416	14 00 11.05 ^s 366.63
5	1 47 16.214 ^s 120.026	8 06 09.56 ^s 524.98	5	3 23 11.349 ^s 120.462	14 06 17.68 ^s 362.70
6	1 49 16.240 ^s 119.988	8 14 54.54 ^s 522.21	6	3 25 11.811 ^s 120.510	14 12 20.38 ^s 358.76
7	1 51 16.228 ^s 119.954	8 23 36.75 ^s 519.39	7	3 27 12.321 ^s 120.558	14 18 19.14 ^s 354.80
8	1 53 16.182 ^s 119.922	8 32 16.14 ^s 516.55	8	3 29 12.879 ^s 120.608	14 24 13.94 ^s 350.81
9	1 55 16.104 ^s 119.891	8 40 52.69 ^s 513.69	9	3 31 13.487 ^s 120.658	14 30 04.75 ^s 346.82
10	1 57 15.995 ^s 119.864	8 49 26.38 ^s 510.79	10	3 33 14.145 ^s 120.710	14 35 51.57 ^s 342.78
11	1 59 15.859 ^s 119.839	8 57 57.17 ^s 507.87	11	3 35 14.855 ^s 120.763	14 41 34.35 ^s 338.74
12	2 01 15.698 ^s 119.815	9 06 25.04 ^s 504.93	12	3 37 15.618 ^s 120.816	14 47 13.09 ^s 334.68
13	2 03 15.513 ^s 119.793	9 14 49.97 ^s 501.94	13	3 39 16.434 ^s 120.871	14 52 47.77 ^s 330.59
14	2 05 15.306 ^s 119.775	9 23 11.91 ^s 498.94	14	3 41 17.305 ^s 120.927	14 58 18.36 ^s 326.49
15	2 07 15.081 ^s 119.758	9 31 30.85 ^s 495.91	15	3 43 18.232 ^s 120.982	15 03 44.85 ^s 322.36
16	2 09 14.839 ^s 119.743	9 39 46.76 ^s 492.86	16	3 45 19.214 ^s 121.040	15 09 07.21 ^s 318.22
17	2 11 14.582 ^s 119.730	9 47 59.62 ^s 489.77	17	3 47 20.254 ^s 121.098	15 14 25.43 ^s 314.05
18	2 13 14.312 ^s 119.720	9 56 09.39 ^s 486.66	18	3 49 21.352 ^s 121.157	15 19 39.48 ^s 309.87
19	2 15 14.032 ^s 119.711	10 04 16.05 ^s 483.53	19	3 51 22.509 ^s 121.216	15 24 49.35 ^s 305.67
20	2 17 13.743 ^s 119.704	10 12 19.58 ^s 480.36	20	3 53 23.725 ^s 121.277	15 29 55.02 ^s 301.45
21	2 19 13.447 ^s 119.700	10 20 19.94 ^s 477.18	21	3 55 25.002 ^s 121.338	15 34 56.47 ^s 297.20
22	2 21 13.147 ^s 119.697	10 28 17.12 ^s 473.97	22	3 57 26.340 ^s 121.399	15 39 53.67 ^s 292.95
23	2 23 12.844 ^s 119.696	10 36 11.09 ^s +470.73	23	3 59 27.739 ^s 121.462	15 44 46.62 ^s +288.67
24	2 25 12.540 ^s	+10 44 01.82 ^s	24	4 01 29.201 ^s	+15 49 35.29 ^s

MOON, 1960
FOR EACH HOUR OF EPHEMERIS TIME

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Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
February 6									February 8								
^h 0	^h 4	^m 01	^s 29.201	^s 121.524	[°] +15	['] 49	["] 35.29	["] +284.37	^h 0	^h 5	^m 39	^s 57.518	^s 124.668	[°] +18	['] 11	["] 08.13	["] +59.19
1	4	03	30.725	121.588	15	54	19.66	280.06	1	5	42	02.186	124.726	18	12	07.32	54.19
2	4	05	32.313	121.652	15	58	59.72	275.72	2	5	44	06.912	124.781	18	13	01.51	49.17
3	4	07	33.965	121.717	16	03	35.44	271.37	3	5	46	11.693	124.836	18	13	50.68	44.11
4	4	09	35.682	121.781	16	08	06.81	267.00	4	5	48	16.529	124.891	18	14	34.82	39.11
5	4	11	37.463	121.847	16	12	33.81	262.61	5	5	50	21.420	124.944	18	15	13.93	34.08
6	4	13	39.310	121.913	16	16	56.42	258.21	6	5	52	26.364	124.997	18	15	48.01	29.02
7	4	15	41.223	121.980	16	21	14.63	253.78	7	5	54	31.361	125.048	18	16	17.03	23.97
8	4	17	43.203	122.045	16	25	28.41	249.34	8	5	56	36.409	125.100	18	16	41.00	18.90
9	4	19	45.248	122.113	16	29	37.75	244.88	9	5	58	41.509	125.149	18	16	59.90	13.83
10	4	21	47.361	122.180	16	33	42.63	240.40	10	6	00	46.658	125.198	18	17	13.73	8.76
11	4	23	49.541	122.248	16	37	43.03	235.91	11	6	02	51.856	125.246	18	17	22.49	+3.68
12	4	25	51.789	122.315	16	41	38.94	231.40	12	6	04	57.102	125.294	18	17	26.17	-1.41
13	4	27	54.104	122.383	16	45	30.34	226.87	13	6	07	02.396	125.339	18	17	24.76	6.51
14	4	29	56.487	122.452	16	49	17.21	222.33	14	6	09	07.735	125.385	18	17	18.25	11.61
15	4	31	58.939	122.520	16	52	59.54	217.77	15	6	11	13.120	125.429	18	17	06.64	16.71
16	4	34	01.459	122.588	16	56	37.31	213.19	16	6	13	18.549	125.472	18	16	49.93	21.81
17	4	36	04.047	122.657	17	00	10.50	208.59	17	6	15	24.021	125.514	18	16	28.12	26.94
18	4	38	06.704	122.725	17	03	39.09	203.99	18	6	17	29.535	125.556	18	16	01.18	32.04
19	4	40	09.429	122.794	17	07	03.08	199.36	19	6	19	35.091	125.595	18	15	29.14	37.17
20	4	42	12.223	122.862	17	10	22.44	194.72	20	6	21	40.686	125.635	18	14	51.97	42.29
21	4	44	15.085	122.931	17	13	37.16	190.07	21	6	23	46.321	125.672	18	14	09.68	47.44
22	4	46	18.016	123.000	17	16	47.23	185.39	22	6	25	51.993	125.709	18	13	22.26	52.54
23	4	48	21.016	123.068	+17	19	52.62	+180.70	23	6	27	57.702	125.746	+18	12	29.72	-57.68
February 7									February 9								
0	4	50	24.084	123.136	+17	22	53.32	+176.01	0	6	30	03.448	125.779	+18	11	32.04	-62.81
1	4	52	27.220	123.205	17	25	49.33	171.28	1	6	32	09.227	125.814	18	10	29.23	67.94
2	4	54	30.425	123.272	17	28	40.61	166.55	2	6	34	15.041	125.846	18	09	21.29	73.08
3	4	56	33.697	123.340	17	31	27.16	161.81	3	6	36	20.887	125.877	18	08	08.21	78.21
4	4	58	37.037	123.408	17	34	08.97	157.05	4	6	38	26.764	125.908	18	06	50.00	83.35
5	5	00	40.445	123.475	17	36	46.02	152.27	5	6	40	32.672	125.936	18	05	26.65	88.49
6	5	02	43.920	123.542	17	39	18.29	147.49	6	6	42	38.608	125.965	18	03	58.16	93.62
7	5	04	47.462	123.609	17	41	45.78	142.68	7	6	44	44.573	125.992	18	02	24.54	98.75
8	5	06	51.071	123.675	17	44	08.46	137.87	8	6	46	50.565	126.017	18	00	45.79	103.89
9	5	08	54.746	123.741	17	46	26.33	133.04	9	6	48	56.582	126.042	17	59	01.90	109.01
10	5	10	58.487	123.806	17	48	39.37	128.20	10	6	51	02.624	126.066	17	57	12.89	114.15
11	5	13	02.293	123.872	17	50	47.57	123.35	11	6	53	08.690	126.087	17	55	18.74	119.27
12	5	15	06.165	123.936	17	52	50.92	118.47	12	6	55	14.777	126.109	17	53	19.47	124.40
13	5	17	10.101	124.001	17	54	49.39	113.60	13	6	57	20.886	126.129	17	51	15.07	129.51
14	5	19	14.102	124.064	17	56	42.99	108.71	14	6	59	27.015	126.148	17	49	05.56	134.63
15	5	21	18.166	124.127	17	58	31.70	103.81	15	7	01	33.163	126.166	17	46	50.93	139.75
16	5	23	22.293	124.191	18	00	15.51	98.89	16	7	03	39.329	126.182	17	44	31.18	144.85
17	5	25	26.484	124.252	18	01	54.40	93.97	17	7	05	45.511	126.198	17	42	06.33	149.96
18	5	27	30.736	124.313	18	03	28.37	89.03	18	7	07	51.709	126.212	17	39	36.37	155.05
19	5	29	35.049	124.375	18	04	57.40	84.08	19	7	09	57.921	126.225	17	37	01.32	160.14
20	5	31	39.424	124.435	18	06	21.48	79.13	20	7	12	04.146	126.238	17	34	21.18	165.23
21	5	33	43.859	124.494	18	07	40.61	74.15	21	7	14	10.384	126.248	17	31	35.95	170.31
22	5	35	48.353	124.553	18	08	54.76	69.18	22	7	16	16.632	126.259	17	28	45.64	175.38
23	5	37	52.906	124.612	18	10	03.94	64.19	23	7	18	22.891	126.267	17	25	50.26	-180.44
24	5	39	57.518		+18	11	08.13		24	7	20	29.158		+17	22	49.82	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 10			February 12		
h	h m s	° ' "	h	h m s	° ' "
0	7 20 29.158 ^{126.275}	+17 22 49.82 ^{-185.50}	0	9 01 21.944 ^{125.646}	+13 23 27.56 ^{-410.41}
1	7 22 35.433 ^{126.281}	17 19 44.32 ^{190.55}	1	9 03 27.590 ^{125.622}	13 16 37.15 ^{414.56}
2	7 24 41.714 ^{126.287}	17 16 33.77 ^{195.59}	2	9 05 33.212 ^{125.597}	13 09 42.59 ^{418.66}
3	7 26 48.001 ^{126.291}	17 13 18.18 ^{200.61}	3	9 07 38.809 ^{125.571}	13 02 43.93 ^{422.75}
4	7 28 54.292 ^{126.295}	17 09 57.57 ^{205.64}	4	9 09 44.380 ^{125.546}	12 55 41.18 ^{426.79}
5	7 31 00.587 ^{126.297}	17 06 31.93 ^{210.65}	5	9 11 49.926 ^{125.521}	12 48 34.39 ^{430.82}
6	7 33 06.884 ^{126.298}	17 03 01.28 ^{215.65}	6	9 13 55.447 ^{125.495}	12 41 23.57 ^{434.80}
7	7 35 13.182 ^{126.299}	16 59 25.63 ^{220.64}	7	9 16 00.942 ^{125.471}	12 34 08.77 ^{438.76}
8	7 37 19.481 ^{126.298}	16 55 44.99 ^{225.61}	8	9 18 06.413 ^{125.446}	12 26 50.01 ^{442.68}
9	7 39 25.779 ^{126.296}	16 51 59.38 ^{230.58}	9	9 20 11.859 ^{125.421}	12 19 27.33 ^{446.58}
10	7 41 32.075 ^{126.294}	16 48 08.80 ^{235.54}	10	9 22 17.280 ^{125.396}	12 12 00.75 ^{450.44}
11	7 43 38.369 ^{126.289}	16 44 13.26 ^{240.47}	11	9 24 22.676 ^{125.373}	12 04 30.31 ^{454.27}
12	7 45 44.658 ^{126.286}	16 40 12.79 ^{245.41}	12	9 26 28.049 ^{125.348}	11 56 56.04 ^{458.07}
13	7 47 50.944 ^{126.279}	16 36 07.38 ^{250.32}	13	9 28 33.397 ^{125.324}	11 49 17.97 ^{461.82}
14	7 49 57.223 ^{126.273}	16 31 57.06 ^{255.22}	14	9 30 38.721 ^{125.301}	11 41 36.15 ^{465.56}
15	7 52 03.496 ^{126.266}	16 27 41.84 ^{260.10}	15	9 32 44.022 ^{125.278}	11 33 50.59 ^{469.24}
16	7 54 09.762 ^{126.257}	16 23 21.74 ^{264.98}	16	9 34 49.300 ^{125.254}	11 26 01.35 ^{472.91}
17	7 56 16.019 ^{126.248}	16 18 56.76 ^{269.83}	17	9 36 54.554 ^{125.233}	11 18 08.44 ^{476.53}
18	7 58 22.267 ^{126.238}	16 14 26.93 ^{274.68}	18	9 38 59.787 ^{125.211}	11 10 11.91 ^{480.12}
19	8 00 28.505 ^{126.227}	16 09 52.25 ^{279.49}	19	9 41 04.998 ^{125.189}	11 02 11.79 ^{483.68}
20	8 02 34.732 ^{126.216}	16 05 12.76 ^{284.31}	20	9 43 10.187 ^{125.168}	10 54 08.11 ^{487.19}
21	8 04 40.948 ^{126.202}	16 00 28.45 ^{289.09}	21	9 45 15.355 ^{125.148}	10 46 00.92 ^{490.67}
22	8 06 47.150 ^{126.190}	15 55 39.36 ^{293.87}	22	9 47 20.503 ^{125.128}	10 37 50.25 ^{494.11}
23	8 08 53.340 ^{126.175}	+15 50 45.49 ^{-298.63}	23	9 49 25.631 ^{125.109}	+10 29 36.14 ^{-497.53}
February 11			February 13		
0	8 10 59.515 ^{126.161}	+15 45 46.86 ^{-303.36}	0	9 51 30.740 ^{125.090}	+10 21 18.61 ^{-500.89}
1	8 13 05.676 ^{126.145}	15 40 43.50 ^{308.08}	1	9 53 35.830 ^{125.073}	10 12 57.72 ^{504.22}
2	8 15 11.821 ^{126.129}	15 35 35.42 ^{312.77}	2	9 55 40.903 ^{125.055}	10 04 33.50 ^{507.52}
3	8 17 17.950 ^{126.112}	15 30 22.65 ^{317.46}	3	9 57 45.958 ^{125.038}	9 56 05.98 ^{510.77}
4	8 19 24.062 ^{126.095}	15 25 05.19 ^{322.11}	4	9 59 50.996 ^{125.023}	9 47 35.21 ^{514.00}
5	8 21 30.157 ^{126.076}	15 19 43.08 ^{326.76}	5	10 01 56.019 ^{125.007}	9 39 01.21 ^{517.16}
6	8 23 36.233 ^{126.058}	15 14 16.32 ^{331.37}	6	10 04 01.026 ^{124.994}	9 30 24.05 ^{520.31}
7	8 25 42.291 ^{126.038}	15 08 44.95 ^{335.96}	7	10 06 06.020 ^{124.980}	9 21 43.74 ^{523.41}
8	8 27 48.329 ^{126.019}	15 03 08.99 ^{340.54}	8	10 08 11.000 ^{124.967}	9 13 00.33 ^{526.46}
9	8 29 54.348 ^{125.998}	14 57 28.45 ^{345.10}	9	10 10 15.967 ^{124.956}	9 04 13.87 ^{529.48}
10	8 32 00.346 ^{125.977}	14 51 43.35 ^{349.62}	10	10 12 20.923 ^{124.945}	8 55 24.39 ^{532.46}
11	8 34 06.323 ^{125.955}	14 45 53.73 ^{354.13}	11	10 14 25.868 ^{124.936}	8 46 31.93 ^{535.40}
12	8 36 12.278 ^{125.934}	14 39 59.60 ^{358.61}	12	10 16 30.804 ^{124.926}	8 37 36.53 ^{538.29}
13	8 38 18.212 ^{125.912}	14 34 00.99 ^{363.07}	13	10 18 35.730 ^{124.919}	8 28 38.24 ^{541.15}
14	8 40 24.124 ^{125.889}	14 27 57.92 ^{367.50}	14	10 20 40.649 ^{124.913}	8 19 37.09 ^{543.96}
15	8 42 30.013 ^{125.866}	14 21 50.42 ^{371.92}	15	10 22 45.562 ^{124.906}	8 10 33.13 ^{546.72}
16	8 44 35.879 ^{125.843}	14 15 38.50 ^{376.29}	16	10 24 50.468 ^{124.902}	8 01 26.41 ^{549.46}
17	8 46 41.722 ^{125.819}	14 09 22.21 ^{380.66}	17	10 26 55.370 ^{124.899}	7 52 16.95 ^{552.14}
18	8 48 47.541 ^{125.795}	14 03 01.55 ^{384.99}	18	10 29 00.269 ^{124.897}	7 43 04.81 ^{554.78}
19	8 50 53.336 ^{125.771}	13 56 36.56 ^{389.30}	19	10 31 05.166 ^{124.896}	7 33 50.03 ^{557.38}
20	8 52 59.107 ^{125.746}	13 50 07.26 ^{393.57}	20	10 33 10.062 ^{124.895}	7 24 32.65 ^{559.94}
21	8 55 04.853 ^{125.722}	13 43 33.69 ^{397.83}	21	10 35 14.957 ^{124.898}	7 15 12.71 ^{562.45}
22	8 57 10.575 ^{125.697}	13 36 55.86 ^{402.05}	22	10 37 19.855 ^{124.900}	7 05 50.26 ^{564.91}
23	8 59 16.272 ^{125.672}	13 30 13.81 ^{-406.25}	23	10 39 24.755 ^{124.904}	6 56 25.35 ^{-567.34}
24	9 01 21.944	+13 23 27.56	24	10 41 29.659	+6 46 58.01

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 14			February 16		
h	h m s	° ' "	h	h m s	° ' "
0	10 41 29.659 ^s	+ 6 46 58.01	0	12 22 01.198 ^s	- 1 18 50.18
1	10 43 34.568 ^{124.909}	6 37 28.30	1	12 24 08.366 ^{127.168}	1 29 16.74
2	10 45 39.484 ^{124.916}	6 27 56.25	2	12 26 15.629 ^{127.263}	1 39 43.21
3	10 47 44.409 ^{124.925}	6 18 21.92	3	12 28 22.991 ^{127.362}	1 50 09.52
4	10 49 49.342 ^{124.933}	6 08 45.34	4	12 30 30.452 ^{127.461}	2 00 35.63
5	10 51 54.287 ^{124.945}	5 59 06.57	5	12 32 38.016 ^{127.564}	2 11 01.47
6	10 53 59.244 ^{124.957}	5 49 25.64	6	12 34 45.684 ^{127.668}	2 21 26.99
7	10 56 04.215 ^{124.971}	5 39 42.62	7	12 36 53.459 ^{127.775}	2 31 52.13
8	10 58 09.201 ^{124.986}	5 29 57.53	8	12 39 01.343 ^{127.884}	2 42 16.85
9	11 00 14.204 ^{125.003}	5 20 10.43	9	12 41 09.338 ^{127.995}	2 52 41.07
10	11 02 19.226 ^{125.022}	5 10 21.37	10	12 43 17.446 ^{128.108}	3 03 04.75
11	11 04 24.267 ^{125.041}	5 00 30.40	11	12 45 25.670 ^{128.224}	3 13 27.82
12	11 06 29.331 ^{125.064}	4 50 37.55	12	12 47 34.011 ^{128.341}	3 23 50.24
13	11 08 34.417 ^{125.086}	4 40 42.89	13	12 49 42.472 ^{128.461}	3 34 11.94
14	11 10 39.529 ^{125.112}	4 30 46.45	14	12 51 51.056 ^{128.584}	3 44 32.87
15	11 12 44.667 ^{125.138}	4 20 48.28	15	12 53 59.763 ^{128.707}	3 54 52.96
16	11 14 49.833 ^{125.166}	4 10 48.44	16	12 56 08.597 ^{128.834}	4 05 12.17
17	11 16 55.029 ^{125.196}	4 00 46.97	17	12 58 17.559 ^{128.962}	4 15 30.43
18	11 19 00.257 ^{125.228}	3 50 43.92	18	13 00 26.653 ^{129.094}	4 25 47.69
19	11 21 05.519 ^{125.262}	3 40 39.34	19	13 02 35.878 ^{129.225}	4 36 03.88
20	11 23 10.815 ^{125.296}	3 30 33.28	20	13 04 45.239 ^{129.361}	4 46 18.95
21	11 25 16.149 ^{125.334}	3 20 25.80	21	13 06 54.738 ^{129.499}	4 56 32.85
22	11 27 21.522 ^{125.373}	3 10 16.93	22	13 09 04.375 ^{129.637}	5 06 45.51
23	11 29 26.935 ^{125.413}	+ 3 00 06.72	23	13 11 14.154 ^{129.779}	- 5 16 56.87
	125.456	-611.48		129.922	-610.00
February 15			February 17		
h	h m s	° ' "	h	h m s	° ' "
0	11 31 32.391 ^{125.500}	+ 2 49 55.24	0	13 13 24.076 ^{130.068}	- 5 27 06.87
1	11 33 37.891 ^{125.546}	2 39 42.53	1	13 15 34.144 ^{130.216}	5 37 15.47
2	11 35 43.437 ^{125.595}	2 29 28.64	2	13 17 44.360 ^{130.365}	5 47 22.59
3	11 37 49.032 ^{125.645}	2 19 13.62	3	13 19 54.725 ^{130.517}	5 57 28.17
4	11 39 54.677 ^{125.697}	2 08 57.52	4	13 22 05.242 ^{130.672}	6 07 32.17
5	11 42 00.374 ^{125.751}	1 58 40.40	5	13 24 15.914 ^{130.827}	6 17 34.52
6	11 44 06.125 ^{125.807}	1 48 22.30	6	13 26 26.741 ^{130.985}	6 27 35.16
7	11 46 11.932 ^{125.865}	1 38 03.28	7	13 28 37.726 ^{131.144}	6 37 34.03
8	11 48 17.797 ^{125.925}	1 27 43.39	8	13 30 48.870 ^{131.307}	6 47 31.07
9	11 50 23.722 ^{125.987}	1 17 22.68	9	13 33 00.177 ^{131.471}	6 57 26.22
10	11 52 29.709 ^{126.051}	1 07 01.20	10	13 35 11.648 ^{131.636}	7 07 19.42
11	11 54 35.760 ^{126.117}	0 56 39.01	11	13 37 23.284 ^{131.804}	7 17 10.61
12	11 56 41.877 ^{126.185}	0 46 16.16	12	13 39 35.088 ^{131.974}	7 26 59.73
13	11 58 48.062 ^{126.256}	0 35 52.70	13	13 41 47.062 ^{132.145}	7 36 46.73
14	12 00 54.318 ^{126.328}	0 25 28.68	14	13 43 59.207 ^{132.318}	7 46 31.53
15	12 03 00.646 ^{126.402}	0 15 04.17	15	13 46 11.525 ^{132.494}	7 56 14.08
16	12 05 07.048 ^{126.479}	+ 0 04 39.20	16	13 48 24.019 ^{132.670}	8 05 54.32
17	12 07 13.527 ^{126.557}	- 0 05 46.16	17	13 50 36.689 ^{132.849}	8 15 32.20
18	12 09 20.084 ^{126.638}	0 16 11.86	18	13 52 49.538 ^{133.029}	8 25 07.63
19	12 11 26.722 ^{126.721}	0 26 37.85	19	13 55 02.567 ^{133.212}	8 34 40.58
20	12 13 33.443 ^{126.806}	0 37 04.07	20	13 57 15.779 ^{133.395}	8 44 10.97
21	12 15 40.249 ^{126.893}	0 47 30.47	21	13 59 29.174 ^{133.581}	8 53 38.75
22	12 17 47.142 ^{126.983}	0 57 56.99	22	14 01 42.755 ^{133.767}	9 03 03.85
23	12 19 54.125 ^{127.073}	1 08 23.58	23	14 03 56.522 ^{133.957}	9 12 26.22
24	12 22 01.198	- 1 18 50.18	24	14 06 10.479	- 9 21 45.79

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
February 18							February 20						
^h	^h	^m	^s	[°]	[']	["]	^h	^h	^m	^s	[°]	[']	["]
0	14	06	10.479	134.146	9	21 45.79	0	15	57	21.971	144.147	15	34 42.37
1	14	08	24.625	134.338		9 31 02.50	1	15	59	46.118	144.349	15	40 30.88
2	14	10	38.963	134.531		9 40 16.29	2	16	02	10.467	144.549	15	46 13.65
3	14	12	53.494	134.726		9 49 27.10	3	16	04	35.016	144.748	15	51 50.62
4	14	15	08.220	134.922		9 58 34.86	4	16	06	59.764	144.946	15	57 21.75
5	14	17	23.142	135.119		10 07 39.53	5	16	09	24.710	145.141	16	02 46.97
6	14	19	38.261	135.318		10 16 41.02	6	16	11	49.851	145.334	16	08 06.24
7	14	21	53.579	135.518		10 25 39.30	7	16	14	15.185	145.527	16	13 19.52
8	14	24	09.097	135.718		10 34 34.28	8	16	16	40.712	145.716	16	18 26.74
9	14	26	24.815	135.922		10 43 25.91	9	16	19	06.428	145.905	16	23 27.86
10	14	28	40.737	136.124		10 52 14.14	10	16	21	32.333	146.090	16	28 22.84
11	14	30	56.861	136.329		11 00 58.89	11	16	23	58.423	146.274	16	33 11.62
12	14	33	13.190	136.535		11 09 40.11	12	16	26	24.697	146.456	16	37 54.16
13	14	35	29.725	136.741		11 18 17.74	13	16	28	51.153	146.635	16	42 30.42
14	14	37	46.466	136.949		11 26 51.71	14	16	31	17.788	146.812	16	47 00.34
15	14	40	03.415	137.157		11 35 21.96	15	16	33	44.600	146.986	16	51 23.89
16	14	42	20.572	137.366		11 43 48.44	16	16	36	11.586	147.158	16	55 41.01
17	14	44	37.938	137.577		11 52 11.08	17	16	38	38.744	147.327	16	59 51.67
18	14	46	55.515	137.787		12 00 29.82	18	16	41	06.071	147.493	17	03 55.83
19	14	49	13.302	137.999		12 08 44.60	19	16	43	33.564	147.658	17	07 53.43
20	14	51	31.301	138.211		12 16 55.36	20	16	46	01.222	147.818	17	11 44.45
21	14	53	49.512	138.423		12 25 02.04	21	16	48	29.040	147.976	17	15 28.84
22	14	56	07.935	138.637		12 33 04.57	22	16	50	57.016	148.131	17	19 06.56
23	14	58	26.572	138.850		12 41 02.90	23	16	53	25.147	148.284	17	22 37.57
February 19							February 21						
0	15	00	45.422	139.065	12	48 56.97	0	16	55	53.431	148.431	17	26 01.83
1	15	03	04.487	139.278		12 56 46.72	1	16	58	21.862	148.578	17	29 19.32
2	15	05	23.765	139.494		13 04 32.08	2	17	00	50.440	148.720	17	32 29.99
3	15	07	43.259	139.708		13 12 13.00	3	17	03	19.160	148.859	17	35 33.80
4	15	10	02.967	139.923		13 19 49.42	4	17	05	48.019	148.994	17	38 30.73
5	15	12	22.890	140.138		13 27 21.28	5	17	08	17.013	149.127	17	41 20.74
6	15	14	43.028	140.354		13 34 48.51	6	17	10	46.140	149.255	17	44 03.80
7	15	17	03.382	140.568		13 42 11.06	7	17	13	15.395	149.380	17	46 39.88
8	15	19	23.950	140.783		13 49 28.88	8	17	15	44.775	149.501	17	49 08.94
9	15	21	44.733	140.998		13 56 41.89	9	17	18	14.276	149.619	17	51 30.97
10	15	24	05.731	141.213		14 03 50.05	10	17	20	43.895	149.733	17	53 45.92
11	15	26	26.944	141.426		14 10 53.30	11	17	23	13.628	149.843	17	55 53.78
12	15	28	48.370	141.640		14 17 51.57	12	17	25	43.471	149.949	17	57 54.51
13	15	31	10.010	141.854		14 24 44.81	13	17	28	13.420	150.051	17	59 48.10
14	15	33	31.864	142.066		14 31 32.97	14	17	30	43.471	150.149	18	01 34.52
15	15	35	53.930	142.278		14 38 15.98	15	17	33	13.620	150.244	18	03 13.74
16	15	38	16.208	142.490		14 44 53.79	16	17	35	43.864	150.333	18	04 45.75
17	15	40	38.698	142.700		14 51 26.34	17	17	38	14.197	150.419	18	06 10.52
18	15	43	01.398	142.910		14 57 53.58	18	17	40	44.616	150.501	18	07 28.04
19	15	45	24.308	143.119		15 04 15.45	19	17	43	15.117	150.579	18	08 38.28
20	15	47	47.427	143.327		15 10 31.90	20	17	45	45.696	150.652	18	09 41.23
21	15	50	10.754	143.534		15 16 42.87	21	17	48	16.348	150.720	18	10 36.88
22	15	52	34.288	143.739		15 22 48.31	22	17	50	47.068	150.786	18	11 25.20
23	15	54	58.027	143.944		15 28 48.16	23	17	53	17.854	150.845	18	12 06.20
24	15	57	21.971			15 34 42.37	24	17	55	48.699		18	12 39.84

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 22			February 24		
h	h m s	° ' "	h	h m s	° ' "
0	17 55 48.699	-18 12 39.84	0	19 56 11.502	-16 16 48.43
1	17 58 19.600	18 13 06.13	1	19 58 39.825	16 11 33.23
2	18 00 50.553	18 13 25.04	2	20 01 07.995	16 06 11.66
3	18 03 21.553	18 13 36.59	3	20 03 36.009	16 00 43.77
4	18 05 52.595	18 13 40.74	4	20 06 03.863	15 55 09.62
5	18 08 23.674	18 13 37.51	5	20 08 31.554	15 49 29.24
6	18 10 54.788	18 13 26.89	6	20 10 59.080	15 43 42.71
7	18 13 25.930	18 13 08.86	7	20 13 26.436	15 37 50.06
8	18 15 57.096	18 12 43.44	8	20 15 53.621	15 31 51.35
9	18 18 28.281	18 12 10.61	9	20 18 20.632	15 25 46.63
10	18 20 59.482	18 11 30.38	10	20 20 47.465	15 19 35.97
11	18 23 30.693	18 10 42.75	11	20 23 14.119	15 13 19.42
12	18 26 01.910	18 09 47.72	12	20 25 40.590	15 06 57.03
13	18 28 33.128	18 08 45.31	13	20 28 06.876	15 00 28.87
14	18 31 04.343	18 07 35.50	14	20 30 32.974	14 53 54.99
15	18 33 35.549	18 06 18.31	15	20 32 58.882	14 47 15.44
16	18 36 06.743	18 04 53.74	16	20 35 24.599	14 40 30.30
17	18 38 37.919	18 03 21.82	17	20 37 50.121	14 33 39.63
18	18 41 09.074	18 01 42.54	18	20 40 15.446	14 26 43.47
19	18 43 40.202	17 59 55.91	19	20 42 40.573	14 19 41.91
20	18 46 11.298	17 58 01.96	20	20 45 05.499	14 12 34.99
21	18 48 42.359	17 56 00.69	21	20 47 30.223	14 05 22.78
22	18 51 13.380	17 53 52.13	22	20 49 54.742	13 58 05.35
23	18 53 44.356	-17 51 36.28	23	20 52 19.055	-13 50 42.76
	150.926	+143.11		144.106	+447.68
February 23			February 25		
h	h m s	° ' "	h	h m s	° ' "
0	18 56 15.282	-17 49 13.17	0	20 54 43.161	-13 43 15.08
1	18 58 46.155	17 46 42.81	1	20 57 07.057	13 35 42.37
2	19 01 16.969	17 44 05.23	2	20 59 30.741	13 28 04.70
3	19 03 47.720	17 41 20.45	3	21 01 54.214	13 20 22.14
4	19 06 18.405	17 38 28.49	4	21 04 17.472	13 12 34.74
5	19 08 49.017	17 35 29.38	5	21 06 40.516	13 04 42.59
6	19 11 19.554	17 32 23.14	6	21 09 03.343	12 56 45.75
7	19 13 50.010	17 29 09.79	7	21 11 25.952	12 48 44.28
8	19 16 20.381	17 25 49.38	8	21 13 48.343	12 40 38.26
9	19 18 50.664	17 22 21.92	9	21 16 10.514	12 32 27.75
10	19 21 20.854	17 18 47.45	10	21 18 32.465	12 24 12.83
11	19 23 50.947	17 15 05.99	11	21 20 54.194	12 15 53.56
12	19 26 20.938	17 11 17.59	12	21 23 15.701	12 07 30.02
13	19 28 50.824	17 07 22.28	13	21 25 36.986	11 59 02.27
14	19 31 20.600	17 03 20.08	14	21 27 58.046	11 50 30.39
15	19 33 50.263	16 59 11.05	15	21 30 18.882	11 41 54.45
16	19 36 19.809	16 54 55.21	16	21 32 39.494	11 33 14.52
17	19 38 49.234	16 50 32.60	17	21 34 59.880	11 24 30.66
18	19 41 18.533	16 46 03.27	18	21 37 20.041	11 15 42.96
19	19 43 47.704	16 41 27.26	19	21 39 39.976	11 06 51.49
20	19 46 16.743	16 36 44.60	20	21 41 59.686	10 57 56.31
21	19 48 45.645	16 31 55.35	21	21 44 19.168	10 48 57.50
22	19 51 14.408	16 26 59.53	22	21 46 38.425	10 39 55.12
23	19 53 43.028	16 21 57.21	23	21 48 57.455	10 30 49.27
24	19 56 11.502	-16 16 48.43	24	21 51 16.258	-10 21 39.99
	148.474	+308.78		138.803	+549.28

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
February 26							February 28						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	21	51	16.258	138°	57'8"	-10 21 39.99	0	23	38	06.116	128°	77'7"	-2 18 42.52
1	21	53	34.836	138°	35'1"	10 12 27.38	1	23	40	14.893	128°	61'1"	2 08 12.53
2	21	55	53.187	138°	12'5"	10 03 11.50	2	23	42	23.504	128°	44'5"	1 57 42.56
3	21	58	11.312	137°	8'9"	9 53 52.42	3	23	44	31.949	128°	28'3"	1 47 12.65
4	22	00	29.211	137°	6'7"	9 44 30.22	4	23	46	40.232	128°	12'1"	1 36 42.87
5	22	02	46.885	137°	4'49"	9 35 04.96	5	23	48	48.353	127°	9'63"	1 26 13.27
6	22	05	04.334	137°	2'25"	9 25 36.73	6	23	50	56.316	127°	8'05"	1 15 43.92
7	22	07	21.559	137°	0'00"	9 16 05.59	7	23	53	04.121	127°	6'50"	1 05 14.88
8	22	09	38.559	136°	7'77"	9 06 31.62	8	23	55	11.771	127°	4'98"	0 54 46.20
9	22	11	55.336	136°	5'54"	8 56 54.89	9	23	57	19.269	127°	3'46"	0 44 17.93
10	22	14	11.890	136°	3'31"	8 47 15.47	10	23	59	26.615	127°	1'97"	0 33 50.14
11	22	16	28.221	136°	1'10"	8 37 33.44	11	00	01	33.812	127°	0'50"	0 23 22.88
12	22	18	44.331	135°	8'88"	8 27 48.86	12	00	03	40.862	126°	9'06"	0 12 56.21
13	22	21	00.219	135°	6'69"	8 18 01.81	13	00	05	47.768	126°	7'62"	-0 02 30.18
14	22	23	15.888	135°	4'50"	8 08 12.36	14	00	07	54.530	126°	6'22"	+0 07 55.16
15	22	25	31.338	135°	2'31"	7 58 20.59	15	00	10	01.152	126°	4'83"	0 18 19.74
16	22	27	46.569	135°	0'13"	7 48 26.56	16	00	12	07.635	126°	3'46"	0 28 43.52
17	22	30	01.582	134°	7'98"	7 38 30.34	17	00	14	13.981	126°	2'12"	0 39 06.44
18	22	32	16.380	134°	5'82"	7 28 32.01	18	00	16	20.193	126°	0'79"	0 49 28.44
19	22	34	30.962	134°	3'67"	7 18 31.64	19	00	18	26.272	125°	9'49"	0 59 49.49
20	22	36	45.329	134°	1'54"	7 08 29.30	20	00	20	32.221	125°	8'21"	1 10 09.51
21	22	38	59.483	133°	9'43"	6 58 25.06	21	00	22	38.042	125°	6'94"	1 20 28.47
22	22	41	13.426	133°	7'31"	6 48 18.98	22	00	24	43.736	125°	5'70"	1 30 46.31
23	22	43	27.157	133°	5'22"	-6 38 11.15	23	00	26	49.306	125°	4'48"	+1 41 02.98
						+609.52							+615.45
February 27							February 29						
0	22	45	40.679	133°	3'13"	-6 28 01.63	0	00	28	54.754	125°	3'29"	+1 51 18.43
1	22	47	53.992	133°	1'06"	6 17 50.49	1	00	31	00.083	125°	2'10"	2 01 32.61
2	22	50	07.098	132°	9'01"	6 07 37.80	2	00	33	05.293	125°	0'95"	2 11 45.48
3	22	52	19.999	132°	6'96"	5 57 23.62	3	00	35	10.388	124°	9'81"	2 21 56.98
4	22	54	32.695	132°	4'94"	5 47 08.04	4	00	37	15.369	124°	8'69"	2 32 07.06
5	22	56	45.189	132°	2'92"	5 36 51.11	5	00	39	20.238	124°	7'60"	2 42 15.67
6	22	58	57.481	132°	0'92"	5 26 32.90	6	00	41	24.998	124°	6'52"	2 52 22.78
7	23	01	09.573	131°	8'93"	5 16 13.48	7	00	43	29.650	124°	5'47"	3 02 28.33
8	23	03	21.466	131°	6'97"	5 05 52.93	8	00	45	34.197	124°	4'44"	3 12 32.28
9	23	05	33.163	131°	5'01"	4 55 31.29	9	00	47	38.641	124°	3'43"	3 22 34.58
10	23	07	44.664	131°	3'08"	4 45 08.66	10	00	49	42.984	124°	2'44"	3 32 35.18
11	23	09	55.972	131°	1'15"	4 34 45.08	11	00	51	47.228	124°	1'46"	3 42 34.04
12	23	12	07.087	130°	9'25"	4 24 20.63	12	00	53	51.374	124°	0'52"	3 52 31.11
13	23	14	18.012	130°	7'37"	4 13 55.37	13	00	55	55.426	123°	9'58"	4 02 26.36
14	23	16	28.749	130°	5'49"	4 03 29.36	14	00	57	59.384	123°	8'68"	4 12 19.74
15	23	18	39.298	130°	3'64"	3 53 02.68	15	00	00	03.252	123°	7'79"	4 22 11.19
16	23	20	49.662	130°	1'80"	3 42 35.38	16	00	02	07.031	123°	6'92"	4 32 00.69
17	23	22	59.842	129°	9'99"	3 32 07.54	17	00	04	10.723	123°	6'07"	4 41 48.19
18	23	25	09.841	129°	8'18"	3 21 39.20	18	00	06	14.330	123°	5'25"	4 51 33.65
19	23	27	19.659	129°	6'40"	3 11 10.45	19	00	08	17.855	123°	4'43"	5 01 17.01
20	23	29	29.299	129°	4'64"	3 00 41.33	20	00	10	21.298	123°	3'65"	5 10 58.26
21	23	31	38.763	129°	2'90"	2 50 11.92	21	00	12	24.663	123°	2'89"	5 20 37.33
22	23	33	48.053	129°	1'17"	2 39 42.27	22	00	14	27.952	123°	2'14"	5 30 14.20
23	23	35	57.170	128°	9'46"	2 29 12.45	23	00	16	31.166	123°	1'40"	5 39 48.83
24	23	38	06.116			-2 18 42.52	24	00	18	34.306			+5 49 21.16
						+629.93							+572.33

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
March 1							March 3						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	1	18	34.306	123°071	+	5 49 21.16	0	2	56	15.217	121°729	+12 31 06.76	+419.74
1	1	20	37.377	123°001		5 58 51.17	1	2	58	16.946	121°738	12 38 06.50	415.92
2	1	22	40.378	122°934		6 08 18.82	2	3	00	18.684	121°747	12 45 02.42	412.10
3	1	24	43.312	122°870		6 17 44.07	3	3	02	20.431	121°758	12 51 54.52	408.25
4	1	26	46.182	122°806		6 27 06.87	4	3	04	22.189	121°769	12 58 42.77	404.38
5	1	28	48.988	122°746		6 36 27.20	5	3	06	23.958	121°782	13 05 27.15	400.48
6	1	30	51.734	122°686		6 45 45.01	6	3	08	25.740	121°796	13 12 07.63	396.57
7	1	32	54.420	122°629		6 55 00.27	7	3	10	27.536	121°812	13 18 44.20	392.63
8	1	34	57.049	122°574		7 04 12.95	8	3	12	29.348	121°827	13 25 16.83	388.67
9	1	36	59.623	122°520		7 13 23.00	9	3	14	31.175	121°844	13 31 45.50	384.69
10	1	39	02.143	122°468		7 22 30.39	10	3	16	33.019	121°862	13 38 10.19	380.69
11	1	41	04.611	122°419		7 31 35.09	11	3	18	34.881	121°882	13 44 30.88	376.67
12	1	43	07.030	122°370		7 40 37.07	12	3	20	36.763	121°901	13 50 47.55	372.62
13	1	45	09.400	122°324		7 49 36.28	13	3	22	38.664	121°923	13 57 00.17	368.57
14	1	47	11.724	122°280		7 58 32.69	14	3	24	40.587	121°944	14 03 08.74	364.48
15	1	49	14.004	122°237		8 07 26.27	15	3	26	42.531	121°967	14 09 13.22	360.38
16	1	51	16.241	122°197		8 16 16.99	16	3	28	44.498	121°990	14 15 13.60	356.25
17	1	53	18.438	122°157		8 25 04.81	17	3	30	46.488	122°015	14 21 09.85	352.12
18	1	55	20.595	122°120		8 33 49.71	18	3	32	48.503	122°041	14 27 01.97	347.95
19	1	57	22.715	122°085		8 42 31.64	19	3	34	50.544	122°066	14 32 49.92	343.78
20	1	59	24.800	122°050		8 51 10.58	20	3	36	52.610	122°094	14 38 33.70	339.57
21	2	01	26.850	122°019		8 59 46.50	21	3	38	54.704	122°121	14 44 13.27	335.36
22	2	03	28.869	121°988		9 08 19.36	22	3	40	56.825	122°149	14 49 48.63	331.12
23	2	05	30.857	121°959	+	9 16 49.13	23	3	42	58.974	122°179	+14 55 19.75	+326.87
March 2							March 4						
0	2	07	32.816	121°932	+	9 25 15.79	0	3	45	01.153	122°208	+15 00 46.62	+322.60
1	2	09	34.748	121°906		9 33 39.30	1	3	47	03.361	122°239	15 06 09.22	318.31
2	2	11	36.654	121°882		9 41 59.63	2	3	49	05.600	122°270	15 11 27.53	314.00
3	2	13	38.536	121°860		9 50 16.76	3	3	51	07.870	122°302	15 16 41.53	309.68
4	2	15	40.396	121°840		9 58 30.65	4	3	53	10.172	122°335	15 21 51.21	305.34
5	2	17	42.236	121°820		10 06 41.28	5	3	55	12.507	122°367	15 26 56.55	300.97
6	2	19	44.056	121°802		10 14 48.62	6	3	57	14.874	122°401	15 31 57.52	296.61
7	2	21	45.858	121°787		10 22 52.63	7	3	59	17.275	122°435	15 36 54.13	292.21
8	2	23	47.645	121°771		10 30 53.29	8	4	01	19.710	122°470	15 41 46.34	287.80
9	2	25	49.416	121°759		10 38 50.58	9	4	03	22.180	122°505	15 46 34.14	283.37
10	2	27	51.175	121°747		10 46 44.47	10	4	05	24.685	122°541	15 51 17.51	278.94
11	2	29	52.922	121°737		10 54 34.92	11	4	07	27.226	122°576	15 55 56.45	274.48
12	2	31	54.659	121°728		11 02 21.91	12	4	09	29.802	122°614	16 00 30.93	270.01
13	2	33	56.387	121°721		11 10 05.43	13	4	11	32.416	122°650	16 05 00.94	265.52
14	2	35	58.108	121°716		11 17 45.42	14	4	13	35.066	122°688	16 09 26.46	261.02
15	2	37	59.824	121°710		11 25 21.89	15	4	15	37.754	122°725	16 13 47.48	256.50
16	2	40	01.534	121°708		11 32 54.79	16	4	17	40.479	122°764	16 18 03.98	251.96
17	2	42	03.242	121°705		11 40 24.10	17	4	19	43.243	122°802	16 22 15.94	247.42
18	2	44	04.947	121°706		11 47 49.80	18	4	21	46.045	122°840	16 26 23.36	242.86
19	2	46	06.653	121°706		11 55 11.87	19	4	23	48.885	122°880	16 30 26.22	238.28
20	2	48	08.359	121°708		12 02 30.27	20	4	25	51.765	122°919	16 34 24.50	233.70
21	2	50	10.067	121°712		12 09 44.98	21	4	27	54.684	122°959	16 38 18.20	229.08
22	2	52	11.779	121°716		12 16 55.98	22	4	29	57.643	122°999	16 42 07.28	224.47
23	2	54	13.495	121°722	+	12 24 03.25	23	4	32	00.642	123°038	16 45 51.75	+219.84
24	2	56	15.217		+12 31 06.76		24	4	34	03.680		+16 49 31.59	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
March 5							March 7						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	4 34	03	680	123-079	+16 49 31.59	+215.19	0	6 13	16.110	124-885	+18 11 00.34	19-58	
1	4 36	06	759	123-119	16 53 06.78	210.54	1	6 15	20.995	124-913	18 10 40.76	24-62	
2	4 38	09	878	123-160	16 56 37.32	205.86	2	6 17	25.908	124-943	18 10 16.14	29-68	
3	4 40	13	038	123-200	17 00 03.18	201.18	3	6 19	30.851	124-970	18 09 46.46	34-73	
4	4 42	16	238	123-242	17 03 24.36	196.48	4	6 21	35.821	124-998	18 09 11.73	39-79	
5	4 44	19	480	123-282	17 06 40.84	191.78	5	6 23	40.819	125-025	18 08 31.94	44-84	
6	4 46	22	762	123-323	17 09 52.62	187.05	6	6 25	45.844	125-052	18 07 47.10	49-91	
7	4 48	26	085	123-364	17 12 59.67	182.32	7	6 27	50.896	125-077	18 06 57.19	54-96	
8	4 50	29	449	123-405	17 16 01.99	177.57	8	6 29	55.973	125-102	18 06 02.23	60-03	
9	4 52	32	854	123-446	17 18 59.56	172.82	9	6 32	01.075	125-128	18 05 02.20	65-09	
10	4 54	36	300	123-487	17 21 52.38	168.05	10	6 34	06.203	125-151	18 03 57.11	70-15	
11	4 56	39	787	123-528	17 24 40.43	163.27	11	6 36	11.354	125-175	18 02 46.96	75-21	
12	4 58	43	315	123-569	17 27 23.70	158.48	12	6 38	16.529	125-199	18 01 31.75	80-27	
13	5 00	46	884	123-610	17 30 02.18	153.68	13	6 40	21.728	125-220	18 00 11.48	85-34	
14	5 02	50	494	123-651	17 32 35.86	148.87	14	6 42	26.948	125-243	17 58 46.14	90-40	
15	5 04	54	145	123-692	17 35 04.73	144.04	15	6 44	32.191	125-264	17 57 15.74	95-45	
16	5 06	57	837	123-732	17 37 28.77	139.22	16	6 46	37.455	125-285	17 55 40.29	100-52	
17	5 09	01	569	123-773	17 39 47.99	134.37	17	6 48	42.740	125-305	17 53 59.77	105-57	
18	5 11	05	342	123-814	17 42 02.36	129.51	18	6 50	48.045	125-325	17 52 14.20	110-63	
19	5 13	09	156	123-853	17 44 11.87	124.66	19	6 52	53.370	125-344	17 50 23.57	115-68	
20	5 15	13	009	123-894	17 46 16.53	119.78	20	6 54	58.714	125-362	17 48 27.89	120-73	
21	5 17	16	903	123-933	17 48 16.31	114.91	21	6 57	04.076	125-381	17 46 27.16	125-78	
22	5 19	20	836	123-973	17 50 11.22	110.01	22	6 59	09.457	125-398	17 44 21.38	130-83	
23	5 21	24	809	124-013	+17 52 01.23	+105.11	23	7 01	14.855	125-415	+17 42 10.55	-135-86	
March 6							March 8						
0	5 23	28	822	124-051	+17 53 46.34	+100.21	0	7 03	20.270	125-431	+17 39 54.69	-140-90	
1	5 25	32	873	124-091	17 55 26.55	95.29	1	7 05	25.701	125-447	17 37 33.79	145-93	
2	5 27	36	964	124-129	17 57 01.84	90.37	2	7 07	31.148	125-462	17 35 07.86	150-97	
3	5 29	41	093	124-167	17 58 32.21	85.43	3	7 09	36.610	125-477	17 32 36.89	155-98	
4	5 31	45	260	124-206	17 59 57.64	80.50	4	7 11	42.087	125-491	17 30 00.91	161-01	
5	5 33	49	466	124-243	18 01 18.14	75.55	5	7 13	47.578	125-504	17 27 19.90	166-01	
6	5 35	53	709	124-281	18 02 33.69	70.59	6	7 15	53.082	125-518	17 24 33.89	171-03	
7	5 37	57	990	124-318	18 03 44.28	65.63	7	7 17	58.600	125-530	17 21 42.86	176-03	
8	5 40	02	308	124-354	18 04 49.91	60.67	8	7 20	04.130	125-543	17 18 46.83	181-02	
9	5 42	06	662	124-391	18 05 50.58	55.68	9	7 22	09.673	125-554	17 15 45.81	186-02	
10	5 44	11	053	124-427	18 06 46.26	50.71	10	7 24	15.227	125-565	17 12 39.79	190-99	
11	5 46	15	480	124-462	18 07 36.97	45.72	11	7 26	20.792	125-575	17 09 28.80	195-97	
12	5 48	19	942	124-498	18 08 22.69	40.72	12	7 28	26.367	125-586	17 06 12.83	200-94	
13	5 50	24	440	124-532	18 09 03.41	35.73	13	7 30	31.953	125-595	17 02 51.89	205-89	
14	5 52	28	972	124-567	18 09 39.14	30.72	14	7 32	37.548	125-605	16 59 26.00	210-85	
15	5 54	33	539	124-600	18 10 09.86	25.71	15	7 34	43.153	125-613	16 55 55.15	215-79	
16	5 56	38	139	124-634	18 10 35.57	20.70	16	7 36	48.766	125-622	16 52 19.36	220-72	
17	5 58	42	773	124-667	18 10 56.27	15.67	17	7 38	54.388	125-629	16 48 38.64	225-64	
18	6 00	47	440	124-700	18 11 11.94	10.65	18	7 41	00.017	125-637	16 44 53.00	230-56	
19	6 02	52	140	124-732	18 11 22.59	5.62	19	7 43	05.654	125-644	16 41 02.44	235-47	
20	6 04	56	872	124-763	18 11 28.21	+0.59	20	7 45	11.298	125-650	16 37 06.97	240-36	
21	6 07	01	635	124-795	18 11 28.80	-4.44	21	7 47	16.948	125-657	16 33 06.61	245-24	
22	6 09	06	430	124-825	18 11 24.36	9.49	22	7 49	22.605	125-662	16 29 01.37	250-11	
23	6 11	11	255	124-855	18 11 14.87	-14.53	23	7 51	28.267	125-668	16 24 51.26	-254-97	
24	6 13	16	110		+18 11 00.34		24	7 53	33.935		+16 20 36.29		

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 9			March 11		
h	h m s	° ' "	h	h m s	° ' "
0	7 53 33.935	+16 20 36.29	0	9 34 09.262	+11 26 40.81
1	7 55 39.608	16 16 16.47	1	9 36 15.096	11 18 49.68
2	7 57 45.286	16 11 51.81	2	9 38 20.939	11 10 54.76
3	7 59 50.968	16 07 22.32	3	9 40 26.793	11 02 56.08
4	8 01 56.655	16 02 48.03	4	9 42 32.657	10 54 53.67
5	8 04 02.345	15 58 08.94	5	9 44 38.533	10 46 47.57
6	8 06 08.039	15 53 25.06	6	9 46 44.421	10 38 37.81
7	8 08 13.736	15 48 36.42	7	9 48 50.322	10 30 24.42
8	8 10 19.436	15 43 43.02	8	9 50 56.236	10 22 07.44
9	8 12 25.139	15 38 44.87	9	9 53 02.165	10 13 46.90
10	8 14 30.845	15 33 42.01	10	9 55 08.109	10 05 22.84
11	8 16 36.553	15 28 34.43	11	9 57 14.068	9 56 55.29
12	8 18 42.264	15 23 22.16	12	9 59 20.045	9 48 24.29
13	8 20 47.976	15 18 05.21	13	10 01 26.038	9 39 49.87
14	8 22 53.690	15 12 43.60	14	10 03 32.050	9 31 12.07
15	8 24 59.406	15 07 17.34	15	10 05 38.082	9 22 30.93
16	8 27 05.124	15 01 46.46	16	10 07 44.133	9 13 46.49
17	8 29 10.843	14 56 10.97	17	10 09 50.205	9 04 58.78
18	8 31 16.564	14 50 30.89	18	10 11 56.300	8 56 07.84
19	8 33 22.286	14 44 46.23	19	10 14 02.417	8 47 13.72
20	8 35 28.010	14 38 57.03	20	10 16 08.558	8 38 16.44
21	8 37 33.735	14 33 03.29	21	10 18 14.724	8 29 16.05
22	8 39 39.461	14 27 05.04	22	10 20 20.916	8 20 12.60
23	8 41 45.189	+14 21 02.29	23	10 22 27.135	+ 8 11 06.11
	125.728	-367.22		126.247	-549.48
March 10			March 12		
0	8 43 50.917	+14 14 55.07	0	10 24 33.382	+ 8 01 56.63
1	8 45 56.648	14 08 43.40	1	10 26 39.659	7 52 44.21
2	8 48 02.379	14 02 27.30	2	10 28 45.965	7 43 28.89
3	8 50 08.113	13 56 06.79	3	10 30 52.303	7 34 10.70
4	8 52 13.848	13 49 41.89	4	10 32 58.673	7 24 49.69
5	8 54 19.585	13 43 12.63	5	10 35 05.077	7 15 25.90
6	8 56 25.323	13 36 39.03	6	10 37 11.515	7 05 59.38
7	8 58 31.064	13 30 01.12	7	10 39 17.990	6 56 30.18
8	9 00 36.808	13 23 18.90	8	10 41 24.502	6 46 58.32
9	9 02 42.554	13 16 32.43	9	10 43 31.052	6 37 23.87
10	9 04 48.302	13 09 41.70	10	10 45 37.643	6 27 46.86
11	9 06 54.054	13 02 46.76	11	10 47 44.274	6 18 07.35
12	9 08 59.809	12 55 47.63	12	10 49 50.947	6 08 25.37
13	9 11 05.568	12 48 44.32	13	10 51 57.664	5 58 40.97
14	9 13 11.331	12 41 36.88	14	10 54 04.427	5 48 54.21
15	9 15 17.098	12 34 25.32	15	10 56 11.235	5 39 05.12
16	9 17 22.869	12 27 09.68	16	10 58 18.091	5 29 13.76
17	9 19 28.646	12 19 49.97	17	11 00 24.996	5 19 20.18
18	9 21 34.428	12 12 26.24	18	11 02 31.951	5 09 24.41
19	9 23 40.216	12 04 58.50	19	11 04 38.958	4 59 26.52
20	9 25 46.011	11 57 26.79	20	11 06 46.019	4 49 26.55
21	9 27 51.812	11 49 51.14	21	11 08 53.134	4 39 24.55
22	9 29 57.621	11 42 11.57	22	11 11 00.305	4 29 20.57
23	9 32 03.437	11 34 28.11	23	11 13 07.534	4 19 14.66
24	9 34 09.262	+11 26 40.81	24	11 15 14.822	+ 4 09 06.88
	125.825	-467.30		127.288	-607.78

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 13			March 15		
h	h m s	° ' " + -	h	h m s	° ' " + -
0	11 15 14.822	127.348 + 4 09 06.88	0	12 58 45.390	132.159 - 4 15 43.60
1	11 17 22.170	127.411 3 58 57.27	1	13 00 57.549	132.299 4 26 13.50
2	11 19 29.581	127.474 3 48 45.89	2	13 03 09.848	132.441 4 36 42.30
3	11 21 37.055	127.539 3 38 32.78	3	13 05 22.289	132.583 4 47 09.93
4	11 23 44.594	127.605 3 28 18.00	4	13 07 34.872	132.729 4 57 36.33
5	11 25 52.199	127.674 3 18 01.61	5	13 09 47.601	132.875 5 08 01.43
6	11 27 59.873	127.744 3 07 43.66	6	13 12 00.476	133.022 5 18 25.15
7	11 30 07.617	127.815 2 57 24.19	7	13 14 13.498	133.171 5 28 47.45
8	11 32 15.432	127.888 2 47 03.27	8	13 16 26.669	133.321 5 39 08.25
9	11 34 23.320	127.962 2 36 40.95	9	13 18 39.990	133.473 5 49 27.47
10	11 36 31.282	128.039 2 26 17.28	10	13 20 53.463	133.627 5 59 45.07
11	11 38 39.321	128.116 2 15 52.33	11	13 23 07.090	133.780 6 10 00.96
12	11 40 47.437	128.196 2 05 26.13	12	13 25 20.870	133.937 6 20 15.08
13	11 42 55.633	128.276 1 54 58.76	13	13 27 34.807	134.093 6 30 27.37
14	11 45 03.909	128.360 1 44 30.27	14	13 29 48.900	134.252 6 40 37.76
15	11 47 12.269	128.443 1 34 00.71	15	13 32 03.152	134.411 6 50 46.17
16	11 49 20.712	128.530 1 23 30.14	16	13 34 17.563	134.572 7 00 52.55
17	11 51 29.242	128.617 1 12 58.61	17	13 36 32.135	134.733 7 10 56.82
18	11 53 37.859	128.706 1 02 26.20	18	13 38 46.868	134.897 7 20 58.92
19	11 55 46.565	128.797 0 51 52.94	19	13 41 01.765	135.061 7 30 58.77
20	11 57 55.362	128.890 0 41 18.91	20	13 43 16.826	135.225 7 40 56.32
21	12 00 04.252	128.984 0 30 44.16	21	13 45 32.051	135.393 7 50 51.50
22	12 02 13.236	129.080 0 20 08.75	22	13 47 47.444	135.559 8 00 44.23
23	12 04 22.316	129.177 + 0 09 32.74	23	13 50 03.003	135.728 - 8 10 34.45
March 14			March 16		
0	12 06 31.493	129.277 - 0 01 03.82	0	13 52 18.731	135.896 - 8 20 22.10
1	12 08 40.770	129.378 0 11 40.86	1	13 54 34.627	136.067 8 30 07.09
2	12 10 50.148	129.480 0 22 18.32	2	13 56 50.694	136.238 8 39 49.38
3	12 12 59.628	129.585 0 32 56.14	3	13 59 06.932	136.410 8 49 28.89
4	12 15 09.213	129.691 0 43 34.25	4	14 01 23.342	136.583 8 59 05.55
5	12 17 18.904	129.798 0 54 12.61	5	14 03 39.925	136.755 9 08 39.29
6	12 19 28.702	129.908 1 04 51.15	6	14 05 56.680	136.930 9 18 10.05
7	12 21 38.610	130.019 1 15 29.80	7	14 08 13.610	137.105 9 27 37.77
8	12 23 48.629	130.132 1 26 08.51	8	14 10 30.715	137.280 9 37 02.36
9	12 25 58.761	130.246 1 36 47.21	9	14 12 47.995	137.456 9 46 23.78
10	12 28 09.007	130.362 1 47 25.83	10	14 15 05.451	137.633 9 55 41.95
11	12 30 19.369	130.480 1 58 04.33	11	14 17 23.084	137.810 10 04 56.80
12	12 32 29.849	130.600 2 08 42.63	12	14 19 40.894	137.988 10 14 08.27
13	12 34 40.449	130.720 2 19 20.66	13	14 21 58.882	138.165 10 23 16.29
14	12 36 51.169	130.843 2 29 58.38	14	14 24 17.047	138.344 10 32 20.80
15	12 39 02.012	130.968 2 40 35.70	15	14 26 35.391	138.523 10 41 21.73
16	12 41 12.980	131.093 2 51 12.58	16	14 28 53.914	138.701 10 50 19.01
17	12 43 24.073	131.221 3 01 48.94	17	14 31 12.615	138.881 10 59 12.58
18	12 45 35.294	131.351 3 12 24.72	18	14 33 31.496	139.061 11 08 02.38
19	12 47 46.645	131.481 3 22 59.86	19	14 35 50.557	139.240 11 16 48.33
20	12 49 58.126	131.613 3 33 34.28	20	14 38 09.797	139.419 11 25 30.38
21	12 52 09.739	131.748 3 44 07.94	21	14 40 29.216	139.599 11 34 08.46
22	12 54 21.487	131.883 3 54 40.75	22	14 42 48.815	139.779 11 42 42.50
23	12 56 33.370	132.020 4 05 12.66	23	14 45 08.594	139.959 11 51 12.45
24	12 58 45.390	- 4 15 43.60	24	14 47 28.553	- 11 59 38.23

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 17			March 19		
h	h m s	° ' "	h	h m s	° ' "
0	14 47 28.553 ^s	-11 59 38.23	0	16 42 41.683 ^s	-17 03 40.99
1	14 49 48.691 ^s	12 07 59.78	1	16 45 09.121 ^s	17 07 34.53
2	14 52 09.008 ^s	12 16 17.05	2	16 47 36.658 ^s	17 11 21.39
3	14 54 29.504 ^s	12 24 29.97	3	16 50 04.293 ^s	17 15 01.54
4	14 56 50.179 ^s	12 32 38.47	4	16 52 32.021 ^s	17 18 34.95
5	14 59 11.032 ^s	12 40 42.50	5	16 54 59.840 ^s	17 22 01.59
6	15 01 32.063 ^s	12 48 41.99	6	16 57 27.747 ^s	17 25 21.43
7	15 03 53.272 ^s	12 56 36.88	7	16 59 55.737 ^s	17 28 34.45
8	15 06 14.658 ^s	13 04 27.12	8	17 02 23.809 ^s	17 31 40.61
9	15 08 36.220 ^s	13 12 12.63	9	17 04 51.958 ^s	17 34 39.89
10	15 10 57.958 ^s	13 19 53.36	10	17 07 20.181 ^s	17 37 32.27
11	15 13 19.871 ^s	13 27 29.26	11	17 09 48.475 ^s	17 40 17.73
12	15 15 41.958 ^s	13 35 00.25	12	17 12 16.837 ^s	17 42 56.24
13	15 18 04.219 ^s	13 42 26.29	13	17 14 45.262 ^s	17 45 27.77
14	15 20 26.652 ^s	13 49 47.31	14	17 17 13.748 ^s	17 47 52.32
15	15 22 49.257 ^s	13 57 03.26	15	17 19 42.290 ^s	17 50 09.85
16	15 25 12.033 ^s	14 04 14.08	16	17 22 10.885 ^s	17 52 20.36
17	15 27 34.978 ^s	14 11 19.72	17	17 24 39.531 ^s	17 54 23.83
18	15 29 58.092 ^s	14 18 20.11	18	17 27 08.222 ^s	17 56 20.23
19	15 32 21.373 ^s	14 25 15.20	19	17 29 36.955 ^s	17 58 09.55
20	15 34 44.820 ^s	14 32 04.94	20	17 32 05.727 ^s	17 59 51.79
21	15 37 08.431 ^s	14 38 49.27	21	17 34 34.534 ^s	18 01 26.92
22	15 39 32.206 ^s	14 45 28.14	22	17 37 03.372 ^s	18 02 54.93
23	15 41 56.143 ^s	-14 52 01.49	23	17 39 32.237 ^s	-18 04 15.82
	144.097	-387.79		148.889	-73.75
March 18			March 20		
h	h m s	° ' "	h	h m s	° ' "
0	15 44 20.240 ^s	-14 58 29.28	0	17 42 01.126 ^s	-18 05 29.57
1	15 46 44.496 ^s	15 04 51.45	1	17 44 30.035 ^s	18 06 36.18
2	15 49 08.909 ^s	15 11 07.94	2	17 46 58.960 ^s	18 07 35.63
3	15 51 33.478 ^s	15 17 18.72	3	17 49 27.897 ^s	18 08 27.93
4	15 53 58.200 ^s	15 23 23.72	4	17 51 56.843 ^s	18 09 13.06
5	15 56 23.074 ^s	15 29 22.90	5	17 54 25.793 ^s	18 09 51.02
6	15 58 48.099 ^s	15 35 16.21	6	17 56 54.744 ^s	18 10 21.81
7	16 01 13.271 ^s	15 41 03.61	7	17 59 23.691 ^s	18 10 45.42
8	16 03 38.589 ^s	15 46 45.03	8	18 01 52.632 ^s	18 11 01.86
9	16 06 04.052 ^s	15 52 20.45	9	18 04 21.562 ^s	18 11 11.13
10	16 08 29.656 ^s	15 57 49.81	10	18 06 50.478 ^s	18 11 13.22
11	16 10 55.400 ^s	16 03 13.06	11	18 09 19.375 ^s	18 11 08.14
12	16 13 21.282 ^s	16 08 30.17	12	18 11 48.249 ^s	18 10 55.89
13	16 15 47.298 ^s	16 13 41.09	13	18 14 17.098 ^s	18 10 36.47
14	16 18 13.448 ^s	16 18 45.77	14	18 16 45.916 ^s	18 10 09.90
15	16 20 39.728 ^s	16 23 44.18	15	18 19 14.701 ^s	18 09 36.17
16	16 23 06.135 ^s	16 28 36.27	16	18 21 43.448 ^s	18 08 55.30
17	16 25 32.668 ^s	16 33 22.01	17	18 24 12.154 ^s	18 08 07.30
18	16 27 59.324 ^s	16 38 01.35	18	18 26 40.814 ^s	18 07 12.17
19	16 30 26.100 ^s	16 42 34.26	19	18 29 09.426 ^s	18 06 09.92
20	16 32 52.993 ^s	16 47 00.69	20	18 31 37.985 ^s	18 05 00.57
21	16 35 20.001 ^s	16 51 20.62	21	18 34 06.488 ^s	18 03 44.13
22	16 37 47.120 ^s	16 55 34.00	22	18 36 34.931 ^s	18 02 20.61
23	16 40 14.349 ^s	16 59 40.80	23	18 39 03.310 ^s	18 00 50.03
24	16 42 41.683 ^s	-17 03 40.99	24	18 41 31.621 ^s	-17 59 12.41
	147.334	-240.19		148.311	+ 97.62

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 21			March 23		
h	m	s	h	m	s
0	18 41 31.621	-17 59 12.41	0	20 37 49.925	-14 32 14.55
1	18 43 59.861	17 57 27.75	1	20 40 11.361	14 25 30.66
2	18 46 28.023	17 55 36.09	2	20 42 32.608	14 18 41.64
3	18 48 56.116	17 53 37.44	3	20 44 53.664	14 11 47.56
4	18 51 24.122	17 51 31.82	4	20 47 14.528	14 04 48.46
5	18 53 52.043	17 49 19.24	5	20 49 35.199	13 57 44.40
6	18 56 19.876	17 46 59.74	6	20 51 55.677	13 50 35.44
7	18 58 47.617	17 44 33.34	7	20 54 15.961	13 43 21.64
8	19 01 15.262	17 42 00.06	8	20 56 36.050	13 36 03.05
9	19 03 42.808	17 39 19.92	9	20 58 55.943	13 28 39.73
10	19 06 10.253	17 36 32.95	10	21 01 15.641	13 21 11.73
11	19 08 37.592	17 33 39.19	11	21 03 35.142	13 13 39.13
12	19 11 04.822	17 30 38.65	12	21 05 54.446	13 06 01.97
13	19 13 31.941	17 27 31.36	13	21 08 13.554	12 58 20.31
14	19 15 58.945	17 24 17.36	14	21 10 32.463	12 50 34.23
15	19 18 25.831	17 20 56.67	15	21 12 51.175	12 42 43.76
16	19 20 52.596	17 17 29.34	16	21 15 09.690	12 34 48.98
17	19 23 19.237	17 13 55.38	17	21 17 28.006	12 26 49.94
18	19 25 45.751	17 10 14.84	18	21 19 46.124	12 18 46.71
19	19 28 12.136	17 06 27.74	19	21 22 04.044	12 10 39.34
20	19 30 38.388	17 02 34.13	20	21 24 21.766	12 02 27.90
21	19 33 04.504	16 58 34.04	21	21 26 39.290	11 54 12.45
22	19 35 30.483	16 54 27.51	22	21 28 56.616	11 45 53.05
23	19 37 56.321	-16 50 14.56	23	21 31 13.744	-11 37 29.76
March 22			March 24		
0	19 40 22.015	-16 45 55.26	0	21 33 30.675	-11 29 02.64
1	19 42 47.563	16 41 29.62	1	21 35 47.409	11 20 31.75
2	19 45 12.964	16 36 57.69	2	21 38 03.946	11 11 57.16
3	19 47 38.213	16 32 19.52	3	21 40 20.286	11 03 18.93
4	19 50 03.309	16 27 35.14	4	21 42 36.431	10 54 37.13
5	19 52 28.249	16 22 44.60	5	21 44 52.380	10 45 51.80
6	19 54 53.032	16 17 47.93	6	21 47 08.134	10 37 03.03
7	19 57 17.654	16 12 45.19	7	21 49 23.694	10 28 10.86
8	19 59 42.115	16 07 36.42	8	21 51 39.059	10 19 15.36
9	20 02 06.411	16 02 21.66	9	21 53 54.232	10 10 16.60
10	20 04 30.541	15 57 00.96	10	21 56 09.213	10 01 14.64
11	20 06 54.503	15 51 34.37	11	21 58 24.001	9 52 09.54
12	20 09 18.295	15 46 01.93	12	22 00 38.599	9 43 01.37
13	20 11 41.914	15 40 23.69	13	22 02 53.007	9 33 50.18
14	20 14 05.361	15 34 39.69	14	22 05 07.225	9 24 36.05
15	20 16 28.631	15 28 50.00	15	22 07 21.255	9 15 19.03
16	20 18 51.725	15 22 54.65	16	22 09 35.098	9 05 59.19
17	20 21 14.640	15 16 53.70	17	22 11 48.754	8 56 36.58
18	20 23 37.375	15 10 47.21	18	22 14 02.225	8 47 11.29
19	20 25 59.928	15 04 35.21	19	22 16 15.512	8 37 43.36
20	20 28 22.299	14 58 17.76	20	22 18 28.615	8 28 12.86
21	20 30 44.485	14 51 54.92	21	22 20 41.536	8 18 39.86
22	20 33 06.485	14 45 26.73	22	22 22 54.277	8 09 04.42
23	20 35 28.299	14 38 53.26	23	22 25 06.837	7 59 26.60
24	20 37 49.925	-14 32 14.55	24	22 27 19.219	-7 49 46.46

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 25			March 27		
h	h m s	° ' "	h	h m s	° ' "
0	22 27 19.219	132.204	0	0 10 12.975	125.551
1	22 29 31.423	132.029	1	0 12 18.526	125.456
2	22 31 43.452	131.853	2	0 14 23.982	125.362
3	22 33 55.305	131.681	3	0 16 29.344	125.271
4	22 36 06.986	131.508	4	0 18 34.615	125.181
5	22 38 18.494	131.337	5	0 20 39.796	125.093
6	22 40 29.831	131.168	6	0 22 44.889	125.007
7	22 42 40.999	131.000	7	0 24 49.896	124.922
8	22 44 51.999	130.834	8	0 26 54.818	124.840
9	22 47 02.833	130.668	9	0 28 59.658	124.760
10	22 49 13.501	130.506	10	0 31 04.418	124.680
11	22 51 24.007	130.343	11	0 33 09.098	124.603
12	22 53 34.350	130.183	12	0 35 13.701	124.528
13	22 55 44.533	130.024	13	0 37 18.229	124.454
14	22 57 54.557	129.867	14	0 39 22.683	124.382
15	23 00 04.424	129.712	15	0 41 27.065	124.313
16	23 02 14.136	129.557	16	0 43 31.378	124.243
17	23 04 23.693	129.405	17	0 45 35.621	124.178
18	23 06 33.098	129.254	18	0 47 39.799	124.112
19	23 08 42.352	129.105	19	0 49 43.911	124.049
20	23 10 51.457	128.958	20	0 51 47.960	123.987
21	23 13 00.415	128.811	21	0 53 51.947	123.928
22	23 15 09.226	128.668	22	0 55 55.875	123.870
23	23 17 17.894	128.526	23	0 57 59.745	123.813
March 26			March 28		
0	23 19 26.420	128.385	0	1 00 03.558	123.758
1	23 21 34.805	128.246	1	1 02 07.316	123.706
2	23 23 43.051	128.109	2	1 04 11.022	123.653
3	23 25 51.160	127.974	3	1 06 14.675	123.604
4	23 27 59.134	127.841	4	1 08 18.279	123.556
5	23 30 06.975	127.708	5	1 10 21.835	123.508
6	23 32 14.683	127.579	6	1 12 25.343	123.464
7	23 34 22.262	127.450	7	1 14 28.807	123.420
8	23 36 29.712	127.325	8	1 16 32.227	123.378
9	23 38 37.037	127.199	9	1 18 35.605	123.338
10	23 40 44.236	127.077	10	1 20 38.943	123.299
11	23 42 51.313	126.956	11	1 22 42.242	123.261
12	23 44 58.269	126.837	12	1 24 45.503	123.226
13	23 47 05.106	126.719	13	1 26 48.729	123.191
14	23 49 11.825	126.604	14	1 28 51.920	123.158
15	23 51 18.429	126.491	15	1 30 55.078	123.126
16	23 53 24.920	126.379	16	1 32 58.204	123.097
17	23 55 31.299	126.269	17	1 35 01.301	123.067
18	23 57 37.568	126.160	18	1 37 04.368	123.041
19	23 59 43.728	126.055	19	1 39 07.409	123.015
20	0 01 49.783	125.950	20	1 41 10.424	122.990
21	0 03 55.733	125.848	21	1 43 13.414	122.967
22	0 06 01.581	125.747	22	1 45 16.381	122.945
23	0 08 07.328	125.647	23	1 47 19.326	122.924
24	0 10 12.975		24	1 49 22.250	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 29			March 31		
h	h m s	s	h	h m s	s
0	1 49 22.250	122.906	0	3 27 39.629	123.136
1	1 51 25.156	122.887	1	3 29 42.765	123.158
2	1 53 28.043	122.871	2	3 31 45.923	123.178
3	1 55 30.914	122.855	3	3 33 49.101	123.200
4	1 57 33.769	122.841	4	3 35 52.301	123.221
5	1 59 36.610	122.828	5	3 37 55.522	123.243
6	2 01 39.438	122.817	6	3 39 58.765	123.266
7	2 03 42.255	122.806	7	3 42 02.031	123.287
8	2 05 45.061	122.796	8	3 44 05.318	123.310
9	2 07 47.857	122.788	9	3 46 08.628	123.333
10	2 09 50.645	122.781	10	3 48 11.961	123.355
11	2 11 53.426	122.774	11	3 50 15.316	123.378
12	2 13 56.200	122.770	12	3 52 18.694	123.402
13	2 15 58.970	122.765	13	3 54 22.096	123.424
14	2 18 01.735	122.763	14	3 56 25.520	123.448
15	2 20 04.498	122.761	15	3 58 28.968	123.472
16	2 22 07.259	122.760	16	4 00 32.440	123.494
17	2 24 10.019	122.760	17	4 02 35.934	123.518
18	2 26 12.779	122.761	18	4 04 39.452	123.542
19	2 28 15.540	122.762	19	4 06 42.994	123.565
20	2 30 18.302	122.766	20	4 08 46.559	123.588
21	2 32 21.068	122.770	21	4 10 50.147	123.612
22	2 34 23.838	122.774	22	4 12 53.759	123.636
23	2 36 26.612	122.779	23	4 14 57.395	123.658
March 30			April 1		
0	2 38 29.391	122.786	0	4 17 01.053	123.682
1	2 40 32.177	122.793	1	4 19 04.735	123.705
2	2 42 34.970	122.801	2	4 21 08.440	123.728
3	2 44 37.771	122.810	3	4 23 12.168	123.751
4	2 46 40.581	122.820	4	4 25 15.919	123.773
5	2 48 43.401	122.829	5	4 27 19.692	123.796
6	2 50 46.230	122.841	6	4 29 23.488	123.819
7	2 52 49.071	122.852	7	4 31 27.307	123.841
8	2 54 51.923	122.864	8	4 33 31.148	123.863
9	2 56 54.787	122.877	9	4 35 35.011	123.884
10	2 58 57.664	122.891	10	4 37 38.895	123.907
11	3 01 00.555	122.906	11	4 39 42.802	123.927
12	3 03 03.461	122.920	12	4 41 46.729	123.949
13	3 05 06.381	122.935	13	4 43 50.678	123.970
14	3 07 09.316	122.952	14	4 45 54.648	123.990
15	3 09 12.268	122.967	15	4 47 58.638	124.011
16	3 11 15.235	122.985	16	4 50 02.649	124.031
17	3 13 18.220	123.003	17	4 52 06.680	124.050
18	3 15 21.223	123.020	18	4 54 10.730	124.070
19	3 17 24.243	123.039	19	4 56 14.800	124.089
20	3 19 27.282	123.057	20	4 58 18.889	124.108
21	3 21 30.339	123.077	21	5 00 22.997	124.126
22	3 23 33.416	123.096	22	5 02 27.123	124.144
23	3 25 36.512	123.117	23	5 04 31.267	124.162
24	3 27 39.629		24	5 06 35.429	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
April 2							April 4						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	5	06	35.429	+17	38	19.03	0	6	46	07.607	+17	57	47.76
1	5	08	39.608	17	40	40.31	1	6	48	12.106	17	56	09.53
2	5	10	43.804	17	42	56.68	2	6	50	16.602	17	54	26.32
3	5	12	48.016	17	45	08.14	3	6	52	21.093	17	52	38.13
4	5	14	52.245	17	47	14.68	4	6	54	25.581	17	50	44.96
5	5	16	56.489	17	49	16.30	5	6	56	30.064	17	48	46.83
6	5	19	00.749	17	51	12.98	6	6	58	34.543	17	46	43.74
7	5	21	05.024	17	53	04.72	7	7	00	39.016	17	44	35.68
8	5	23	09.313	17	54	51.52	8	7	02	43.485	17	42	22.68
9	5	25	13.616	17	56	33.36	9	7	04	47.948	17	40	04.72
10	5	27	17.933	17	58	10.25	10	7	06	52.405	17	37	41.83
11	5	29	22.263	17	59	42.17	11	7	08	56.856	17	35	14.00
12	5	31	26.606	18	01	09.13	12	7	11	01.301	17	32	41.24
13	5	33	30.961	18	02	31.12	13	7	13	05.740	17	30	03.56
14	5	35	35.328	18	03	48.12	14	7	15	10.173	17	27	20.97
15	5	37	39.707	18	05	00.15	15	7	17	14.598	17	24	33.46
16	5	39	44.096	18	06	07.19	16	7	19	19.017	17	21	41.06
17	5	41	48.496	18	07	09.23	17	7	21	23.429	17	18	43.77
18	5	43	52.906	18	08	06.29	18	7	23	27.834	17	15	41.58
19	5	45	57.325	18	08	58.35	19	7	25	32.232	17	12	34.53
20	5	48	01.754	18	09	45.40	20	7	27	36.622	17	09	22.60
21	5	50	06.191	18	10	27.46	21	7	29	41.005	17	06	05.82
22	5	52	10.637	18	11	04.51	22	7	31	45.381	17	02	44.18
23	5	54	15.090	+18	11	36.55	23	7	33	49.750	+16	59	17.71
			124.460			27.03				124.360			-211.31
April 3							April 5						
0	5	56	19.550	+18	12	03.58	0	7	35	54.110	+16	55	46.40
1	5	58	24.017	18	12	25.60	1	7	37	58.464	16	52	10.27
2	6	00	28.491	18	12	42.60	2	7	40	02.810	16	48	29.32
3	6	02	32.970	18	12	54.59	3	7	42	07.148	16	44	43.57
4	6	04	37.455	18	13	01.56	4	7	44	11.480	16	40	53.03
5	6	06	41.945	18	13	03.51	5	7	46	15.803	16	36	57.71
6	6	08	46.439	18	13	00.45	6	7	48	20.120	16	32	57.62
7	6	10	50.937	18	12	52.36	7	7	50	24.429	16	28	52.76
8	6	12	55.439	18	12	39.26	8	7	52	28.732	16	24	43.16
9	6	14	59.944	18	12	21.14	9	7	54	33.027	16	20	28.82
10	6	17	04.452	18	11	58.00	10	7	56	37.316	16	16	09.76
11	6	19	08.962	18	11	29.84	11	7	58	41.598	16	11	45.98
12	6	21	13.473	18	10	56.66	12	8	00	45.874	16	07	17.50
13	6	23	17.986	18	10	18.47	13	8	02	50.143	16	02	44.33
14	6	25	22.500	18	09	35.26	14	8	04	54.407	15	58	06.49
15	6	27	27.015	18	08	47.04	15	8	06	58.665	15	53	23.98
16	6	29	31.530	18	07	53.80	16	8	09	02.917	15	48	36.83
17	6	31	36.044	18	06	55.56	17	8	11	07.165	15	43	45.04
18	6	33	40.558	18	05	52.30	18	8	13	11.407	15	38	48.63
19	6	35	45.071	18	04	44.04	19	8	15	15.645	15	33	47.61
20	6	37	49.583	18	03	30.78	20	8	17	19.879	15	28	41.99
21	6	39	54.092	18	02	12.52	21	8	19	24.109	15	23	31.80
22	6	41	58.600	18	00	49.26	22	8	21	28.335	15	18	17.05
23	6	44	03.105	17	59	21.00	23	8	23	32.559	15	12	57.75
24	6	46	07.607	+17	57	47.76	24	8	25	36.780	+15	07	33.91

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 6			April 8		
h	h m s	° ' "	h	h m s	° ' "
0	8 25 36.780	+15 07 33.91	0	10 05 10.017	+9 25 58.84
1	8 27 40.998	15 02 05.56	1	10 07 15.075	9 17 18.32
2	8 29 45.215	14 56 32.71	2	10 09 20.179	9 08 34.45
3	8 31 49.431	14 50 55.37	3	10 11 25.329	8 59 47.27
4	8 33 53.647	14 45 13.57	4	10 13 30.529	8 50 56.80
5	8 35 57.862	14 39 27.32	5	10 15 35.778	8 42 03.08
6	8 38 02.078	14 33 36.63	6	10 17 41.078	8 33 06.16
7	8 40 06.294	14 27 41.52	7	10 19 46.432	8 24 06.05
8	8 42 10.512	14 21 42.02	8	10 21 51.840	8 15 02.80
9	8 44 14.733	14 15 38.14	9	10 23 57.305	8 05 56.44
10	8 46 18.956	14 09 29.90	10	10 26 02.827	7 56 47.01
11	8 48 23.183	14 03 17.31	11	10 28 08.409	7 47 34.55
12	8 50 27.414	13 57 00.40	12	10 30 14.052	7 38 19.09
13	8 52 31.650	13 50 39.19	13	10 32 19.757	7 29 00.66
14	8 54 35.891	13 44 13.69	14	10 34 25.526	7 19 39.32
15	8 56 40.139	13 37 43.92	15	10 36 31.362	7 10 15.10
16	8 58 44.394	13 31 09.91	16	10 38 37.265	7 00 48.03
17	9 00 48.657	13 24 31.68	17	10 40 43.237	6 51 18.15
18	9 02 52.929	13 17 49.24	18	10 42 49.281	6 41 45.51
19	9 04 57.210	13 11 02.62	19	10 44 55.397	6 32 10.15
20	9 07 01.502	13 04 11.84	20	10 47 01.588	6 22 32.10
21	9 09 05.805	12 57 16.92	21	10 49 07.855	6 12 51.42
22	9 11 10.120	12 50 17.88	22	10 51 14.199	6 03 08.13
23	9 13 14.448	+12 43 14.75	23	10 53 20.624	+5 53 22.29
	124.342	-427.20		126.506	-588.36
April 7			April 9		
h	h m s	° ' "	h	h m s	° ' "
0	9 15 18.790	+12 36 07.55	0	10 55 27.130	+5 43 33.93
1	9 17 23.148	12 28 56.30	1	10 57 33.719	5 33 43.10
2	9 19 27.521	12 21 41.03	2	10 59 40.394	5 23 49.84
3	9 21 31.911	12 14 21.75	3	11 01 47.155	5 13 54.21
4	9 23 36.320	12 06 58.50	4	11 03 54.005	5 03 56.23
5	9 25 40.747	11 59 31.29	5	11 06 00.946	4 53 55.97
6	9 27 45.194	11 52 00.16	6	11 08 07.979	4 43 53.46
7	9 29 49.663	11 44 25.13	7	11 10 15.107	4 33 48.75
8	9 31 54.154	11 36 46.22	8	11 12 22.330	4 23 41.88
9	9 33 58.668	11 29 03.45	9	11 14 29.652	4 13 32.92
10	9 36 03.207	11 21 16.87	10	11 16 37.073	4 03 21.89
11	9 38 07.772	11 13 26.49	11	11 18 44.597	3 53 08.86
12	9 40 12.363	11 05 32.34	12	11 20 52.223	3 42 53.87
13	9 42 16.983	10 57 34.44	13	11 22 59.956	3 32 36.98
14	9 44 21.631	10 49 32.83	14	11 25 07.796	3 22 18.22
15	9 46 26.311	10 41 27.53	15	11 27 15.745	3 11 57.66
16	9 48 31.022	10 33 18.58	16	11 29 23.805	3 01 35.34
17	9 50 35.767	10 25 06.00	17	11 31 31.979	2 51 11.31
18	9 52 40.545	10 16 49.82	18	11 33 40.268	2 40 45.63
19	9 54 45.360	10 08 30.06	19	11 35 48.674	2 30 18.36
20	9 56 50.212	10 00 06.77	20	11 37 57.198	2 19 49.53
21	9 58 55.102	9 51 39.97	21	11 40 05.844	2 09 19.21
22	10 01 00.032	9 43 09.70	22	11 42 14.612	1 58 47.46
23	10 03 05.003	9 34 35.97	23	11 44 23.505	1 48 14.32
24	10 05 10.017	+9 25 58.84	24	11 46 32.525	+1 37 39.86
	125.014	-517.13		129.020	-634.46

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
April 10							April 12						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	11	46	32.525	129.148	+	1 37 39.86	0	13	32	50.379	-	6 55 41.69	-621.23
1	11	48	41.673	129.279		1 27 04.12	1	13	35	07.771	137.392	7 06 02.92	619.19
2	11	50	50.952	129.411		1 16 27.16	2	13	37	25.371	137.600	7 16 22.11	617.05
3	11	53	00.363	129.546		1 05 49.05	3	13	39	43.177	137.806	7 26 39.16	614.86
4	11	55	09.909	129.681		0 55 09.84	4	13	42	01.192	138.015	7 36 54.02	612.57
5	11	57	19.590	129.820		0 44 29.59	5	13	44	19.416	138.224	7 47 06.59	610.22
6	11	59	29.410	129.960		0 33 48.35	6	13	46	37.849	138.433	7 57 16.81	607.79
7	12	01	39.370	130.102		0 23 06.19	7	13	48	56.493	138.644	8 07 24.60	605.28
8	12	03	49.472	130.246		0 12 23.16	8	13	51	15.348	138.855	8 17 29.88	602.68
9	12	05	59.718	130.392	+	0 01 39.33	9	13	53	34.415	139.067	8 27 32.56	600.03
10	12	08	10.110	130.539	-	0 09 05.25	10	13	55	53.693	139.278	8 37 32.59	597.27
11	12	10	20.649	130.689		0 19 50.51	11	13	58	13.185	139.492	8 47 29.86	594.46
12	12	12	31.338	130.840		0 30 36.39	12	14	00	32.889	139.704	8 57 24.32	591.57
13	12	14	42.178	130.994		0 41 22.83	13	14	02	52.806	139.917	9 07 15.89	588.58
14	12	16	53.172	131.148		0 52 09.76	14	14	05	12.938	140.132	9 17 04.47	585.53
15	12	19	04.320	131.306		1 02 57.13	15	14	07	33.283	140.345	9 26 50.00	582.41
16	12	21	15.626	131.465		1 13 44.86	16	14	09	53.842	140.559	9 36 32.41	579.19
17	12	23	27.091	131.625		1 24 32.90	17	14	12	14.616	140.774	9 46 11.60	575.91
18	12	25	38.716	131.787		1 35 21.18	18	14	14	35.603	140.987	9 55 47.51	572.55
19	12	27	50.503	131.952		1 46 09.64	19	14	16	56.806	141.203	10 05 20.06	569.10
20	12	30	02.455	132.117		1 56 58.20	20	14	19	18.222	141.416	10 14 49.16	565.59
21	12	32	14.572	132.285		2 07 46.81	21	14	21	39.852	141.630	10 24 14.75	562.00
22	12	34	26.857	132.455		2 18 35.39	22	14	24	01.697	141.845	10 33 36.75	558.32
23	12	36	39.312	132.626	-	2 29 23.88	23	14	26	23.755	142.058	-10 42 55.07	-554.58
						-648.33					142.271		
April 11							April 13						
0	12	38	51.938	132.799	-	2 40 12.21	0	14	28	46.026	142.484	-10 52 09.65	-550.76
1	12	41	04.737	132.973		2 51 00.32	1	14	31	08.510	142.697	11 01 20.41	546.85
2	12	43	17.710	133.150		3 01 48.13	2	14	33	31.207	142.909	11 10 27.26	542.88
3	12	45	30.860	133.327		3 12 35.58	3	14	35	54.116	143.120	11 19 30.14	538.83
4	12	47	44.187	133.507		3 23 22.59	4	14	38	17.236	143.331	11 28 28.97	534.70
5	12	49	57.694	133.688		3 34 09.10	5	14	40	40.567	143.541	11 37 23.67	530.50
6	12	52	11.382	133.871		3 44 55.04	6	14	43	04.108	143.750	11 46 14.17	526.23
7	12	54	25.253	134.054		3 55 40.34	7	14	45	27.858	143.959	11 55 00.40	521.87
8	12	56	39.307	134.241		4 06 24.92	8	14	47	51.817	144.165	12 03 42.27	517.45
9	12	58	53.548	134.427		4 17 08.71	9	14	50	15.982	144.373	12 12 19.72	512.95
10	13	01	07.975	134.617		4 27 51.65	10	14	52	40.355	144.577	12 20 52.67	508.38
11	13	03	22.592	134.806		4 38 33.66	11	14	55	04.932	144.781	12 29 21.05	503.74
12	13	05	37.398	134.998		4 49 14.66	12	14	57	29.713	144.985	12 37 44.79	499.02
13	13	07	52.396	135.191		4 59 54.59	13	14	59	54.698	145.185	12 46 03.81	494.23
14	13	10	07.587	135.385		5 10 33.37	14	15	02	19.883	145.386	12 54 18.04	489.37
15	13	12	22.972	135.580		5 21 10.93	15	15	04	45.269	145.584	13 02 27.41	484.44
16	13	14	38.552	135.777		5 31 47.19	16	15	07	10.853	145.782	13 10 31.85	479.45
17	13	16	54.329	135.975		5 42 22.08	17	15	09	36.635	145.976	13 18 31.30	474.37
18	13	19	10.304	136.175		5 52 55.53	18	15	12	02.611	146.171	13 26 25.67	469.23
19	13	21	26.479	136.375		6 03 27.46	19	15	14	28.782	146.362	13 34 14.90	464.02
20	13	23	42.854	136.576		6 13 57.80	20	15	16	55.144	146.552	13 41 58.92	458.75
21	13	25	59.430	136.779		6 24 26.46	21	15	19	21.696	146.741	13 49 37.67	453.41
22	13	28	16.209	136.982		6 34 53.38	22	15	21	48.437	146.926	13 57 11.08	448.00
23	13	30	33.191	137.188		6 45 18.49	23	15	24	15.363	147.111	14 04 39.08	-442.52
24	13	32	50.379		-	6 55 41.69	24	15	26	42.474		-14 12 01.60	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination				
April 14									April 16									
^h	^h	^m	^s	^s	[°]	[']	["]	["]	^h	^h	^m	^s	^s	[°]	[']	["]	["]	
0	15	26	42	474	147	292	-14	12 01 60	-436 98	0	17	27	00	799	152 096	-18	01 01 26	-113 47
1	15	29	09	766	147 472	14 19 18 58	431 38		1	17	29	32	895	152 093	18 02 54 73	106 01		
2	15	31	37	238	147 649	14 26 29 96	425 71		2	17	32	04	988	152 084	18 04 40 74	98 52		
3	15	34	04	887	147 824	14 33 35 67	419 98		3	17	34	37	072	152 072	18 06 19 26	91 05		
4	15	36	32	711	147 996	14 40 35 65	414 18		4	17	37	09	144	152 054	18 07 50 31	83 57		
5	15	39	00	707	148 165	14 47 29 83	408 34		5	17	39	41	198	152 032	18 09 13 88	76 07		
6	15	41	28	872	148 333	14 54 18 17	402 41		6	17	42	13	230	152 004	18 10 29 95	68 58		
7	15	43	57	205	148 497	15 01 00 58	396 45		7	17	44	45	234	151 973	18 11 38 53	61 09		
8	15	46	25	702	148 659	15 07 37 03	390 41		8	17	47	17	207	151 937	18 12 39 62	53 59		
9	15	48	54	361	148 817	15 14 07 44	384 32		9	17	49	49	144	151 896	18 13 33 21	46 10		
10	15	51	23	178	148 973	15 20 31 76	378 18		10	17	52	21	040	151 849	18 14 19 31	38 61		
11	15	53	52	151	149 126	15 26 49 94	371 97		11	17	54	52	889	151 800	18 14 57 92	31 13		
12	15	56	21	277	149 276	15 33 01 91	365 72		12	17	57	24	689	151 744	18 15 29 05	23 64		
13	15	58	50	553	149 422	15 39 07 63	359 41		13	17	59	56	433	151 684	18 15 52 69	16 17		
14	16	01	19	975	149 565	15 45 07 04	353 04		14	18	02	28	117	151 620	18 16 08 86	8 70		
15	16	03	49	540	149 706	15 51 00 08	346 63		15	18	04	59	737	151 551	18 16 17 56	1 24		
16	16	06	19	246	149 841	15 56 46 71	340 16		16	18	07	31	288	151 478	18 16 18 80	6 21		
17	16	08	49	087	149 975	16 02 26 87	333 65		17	18	10	02	766	151 400	18 16 12 59	13 64		
18	16	11	19	062	150 105	16 08 00 52	327 08		18	18	12	34	166	151 317	18 15 58 95	21 06		
19	16	13	49	167	150 231	16 13 27 60	320 47		19	18	15	05	483	151 231	18 15 37 89	28 48		
20	16	16	19	398	150 353	16 18 48 07	313 82		20	18	17	36	714	151 139	18 15 09 41	35 87		
21	16	18	49	751	150 472	16 24 01 89	307 11		21	18	20	07	853	151 043	18 14 33 54	43 24		
22	16	21	20	223	150 587	16 29 09 00	300 36		22	18	22	38	896	150 944	18 13 50 30	50 61		
23	16	23	50	810	150 698	-16 34 09 36	-293 57		23	18	25	09	840	150 839	-18 12 59 69	+ 57 95		
April 15									April 17									
0	16	26	21	508	150 806	-16 39 02 93	-286 74		0	18	27	40	679	150 731	-18 12 01 74	+ 65 27		
1	16	28	52	314	150 909	16 43 49 67	279 86		1	18	30	11	410	150 618	18 10 56 47	72 57		
2	16	31	23	223	151 008	16 48 29 53	272 95		2	18	32	42	028	150 501	18 09 43 90	79 84		
3	16	33	54	231	151 103	16 53 02 48	266 01		3	18	35	12	529	150 380	18 08 24 06	87 10		
4	16	36	25	334	151 195	16 57 28 49	259 01		4	18	37	42	909	150 255	18 06 56 96	94 34		
5	16	38	56	529	151 282	17 01 47 50	251 99		5	18	40	13	164	150 127	18 05 22 62	101 53		
6	16	41	27	811	151 365	17 05 59 49	244 94		6	18	42	43	291	149 993	18 03 41 09	108 71		
7	16	43	59	176	151 443	17 10 04 43	237 84		7	18	45	13	284	149 857	18 01 52 38	115 87		
8	16	46	30	619	151 518	17 14 02 27	230 72		8	18	47	43	141	149 716	17 59 56 51	122 98		
9	16	49	02	137	151 588	17 17 52 99	223 56		9	18	50	12	857	149 572	17 57 53 53	130 08		
10	16	51	33	725	151 654	17 21 36 55	216 39		10	18	52	42	429	149 423	17 55 43 45	137 13		
11	16	54	05	379	151 714	17 25 12 94	209 17		11	18	55	11	852	149 273	17 53 26 32	144 17		
12	16	56	37	093	151 772	17 28 42 11	201 93		12	18	57	41	125	149 117	17 51 02 15	151 15		
13	16	59	08	865	151 824	17 32 04 04	194 67		13	19	00	10	242	148 958	17 48 31 00	158 12		
14	17	01	40	689	151 872	17 35 18 71	187 39		14	19	02	39	200	148 796	17 45 52 88	165 05		
15	17	04	12	561	151 915	17 38 26 10	180 07		15	19	05	07	996	148 631	17 43 07 83	171 94		
16	17	06	44	476	151 953	17 41 26 17	172 74		16	19	07	36	627	148 462	17 40 15 89	178 79		
17	17	09	16	429	151 988	17 44 18 91	165 39		17	19	10	05	089	148 291	17 37 17 10	185 61		
18	17	11	48	417	152 017	17 47 04 30	158 01		18	19	12	33	380	148 115	17 34 11 49	192 39		
19	17	14	20	434	152 042	17 49 42 31	150 63		19	19	15	01	495	147 937	17 30 59 10	199 13		
20	17	16	52	476	152 062	17 52 12 94	143 22		20	19	17	29	432	147 756	17 27 39 97	205 83		
21	17	19	24	538	152 078	17 54 36 16	135 81		21	19	19	57	188	147 572	17 24 14 14	212 48		
22	17	21	56	616	152 089	17 56 51 97	128 37		22	19	22	24	760	147 385	17 20 41 66	219 10		
23	17	24	28	705	152 094	-17 59 00 34	-120 92		23	19	24	52	145	147 196	17 17 02 56	+ 225 68		
24	17	27	00	799		-18 01 01 26			24	19	27	19	341		-17 13 16 88			

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 18			April 20		
h	h m s	° ' "	h	h m s	° ' "
0	19 27 19.341 ^s	-17 13 16.88	0	21 20 47.218 ^s	-12 20 12.17
1	19 29 46.344 ^{147.003}	17 09 24.67 ^{+232.21}	1	21 23 03.363 ^{136.145}	12 12 07.68 ^{+484.49}
2	19 32 13.152 ^{146.808}	17 05 25.98 ^{238.69}	2	21 25 19.277 ^{135.914}	12 03 59.35 ^{488.33}
3	19 34 39.763 ^{146.611}	17 01 20.84 ^{245.14}	3	21 27 34.962 ^{135.685}	11 55 47.23 ^{492.12}
4	19 37 06.174 ^{146.411}	16 57 09.30 ^{251.54}	4	21 29 50.419 ^{135.457}	11 47 31.38 ^{495.85}
5	19 39 32.383 ^{146.209}	16 52 51.42 ^{257.88}	5	21 32 05.648 ^{135.229}	11 39 11.87 ^{499.51}
6	19 41 58.387 ^{146.004}	16 48 27.23 ^{264.19}	6	21 34 20.652 ^{135.004}	11 30 48.74 ^{503.13}
7	19 44 24.184 ^{145.797}	16 43 56.78 ^{270.45}	7	21 36 35.430 ^{134.778}	11 22 22.06 ^{506.68}
8	19 46 49.773 ^{145.589}	16 39 20.13 ^{276.65}	8	21 38 49.983 ^{134.553}	11 13 51.90 ^{510.16}
9	19 49 15.150 ^{145.377}	16 34 37.31 ^{282.82}	9	21 41 04.314 ^{134.331}	11 05 18.30 ^{513.60}
10	19 51 40.315 ^{145.165}	16 29 48.39 ^{288.92}	10	21 43 18.424 ^{134.110}	10 56 41.34 ^{516.96}
11	19 54 05.264 ^{144.949}	16 24 53.40 ^{294.99}	11	21 45 32.313 ^{133.889}	10 48 01.07 ^{520.27}
12	19 56 29.997 ^{144.733}	16 19 52.40 ^{301.00}	12	21 47 45.983 ^{133.670}	10 39 17.54 ^{523.53}
13	19 58 54.512 ^{144.515}	16 14 45.44 ^{306.96}	13	21 49 59.436 ^{133.453}	10 30 30.83 ^{526.71}
14	20 01 18.807 ^{144.295}	16 09 32.57 ^{312.87}	14	21 52 12.673 ^{133.237}	10 21 40.98 ^{529.85}
15	20 03 42.880 ^{144.073}	16 04 13.85 ^{318.72}	15	21 54 25.694 ^{133.021}	10 12 48.06 ^{532.92}
16	20 06 06.730 ^{143.850}	15 58 49.32 ^{324.53}	16	21 56 38.503 ^{132.809}	10 03 52.14 ^{535.92}
17	20 08 30.355 ^{143.625}	15 53 19.04 ^{330.28}	17	21 58 51.100 ^{132.597}	9 54 53.25 ^{538.89}
18	20 10 53.755 ^{143.400}	15 47 43.06 ^{335.98}	18	22 01 03.486 ^{132.386}	9 45 51.48 ^{541.77}
19	20 13 16.927 ^{143.172}	15 42 01.44 ^{341.62}	19	22 03 15.665 ^{132.179}	9 36 46.87 ^{544.61}
20	20 15 39.871 ^{142.944}	15 36 14.23 ^{347.21}	20	22 05 27.636 ^{131.971}	9 27 39.48 ^{547.39}
21	20 18 02.586 ^{142.715}	15 30 21.48 ^{352.75}	21	22 07 39.402 ^{131.766}	9 18 29.38 ^{550.10}
22	20 20 25.071 ^{142.485}	15 24 23.25 ^{358.23}	22	22 09 50.965 ^{131.563}	9 09 16.61 ^{552.77}
23	20 22 47.324 ^{142.253}	-15 18 19.59 ^{363.66}	23	22 12 02.325 ^{131.360}	-9 00 01.25 ^{555.36}
		^{+369.03}			^{+557.90}
April 19			April 21		
h	h m s	° ' "	h	h m s	° ' "
0	20 25 09.345	-15 12 10.56	0	22 14 13.486	-8 50 43.35
1	20 27 31.133 ^{141.788}	15 05 56.22 ^{+374.34}	1	22 16 24.449 ^{130.963}	8 41 22.97 ^{+560.38}
2	20 29 52.687 ^{141.554}	14 59 36.63 ^{379.59}	2	22 18 35.215 ^{130.766}	8 32 00.16 ^{562.81}
3	20 32 14.007 ^{141.320}	14 53 11.83 ^{384.80}	3	22 20 45.787 ^{130.572}	8 22 34.99 ^{565.17}
4	20 34 35.092 ^{141.085}	14 46 41.88 ^{389.95}	4	22 22 56.166 ^{130.379}	8 13 07.50 ^{567.49}
5	20 36 55.941 ^{140.849}	14 40 06.85 ^{395.03}	5	22 25 06.354 ^{130.188}	8 03 37.77 ^{569.73}
6	20 39 16.555 ^{140.614}	14 33 26.79 ^{400.06}	6	22 27 16.354 ^{130.000}	7 54 05.85 ^{571.92}
7	20 41 36.933 ^{140.378}	14 26 41.75 ^{405.04}	7	22 29 26.166 ^{129.812}	7 44 31.79 ^{574.06}
8	20 43 57.074 ^{140.141}	14 19 51.81 ^{409.94}	8	22 31 35.794 ^{129.628}	7 34 55.65 ^{576.14}
9	20 46 16.979 ^{139.905}	14 12 57.00 ^{414.81}	9	22 33 45.239 ^{129.445}	7 25 17.50 ^{578.15}
10	20 48 36.647 ^{139.668}	14 05 57.40 ^{419.60}	10	22 35 54.503 ^{129.264}	7 15 37.38 ^{580.12}
11	20 50 56.078 ^{139.431}	13 58 53.06 ^{424.34}	11	22 38 03.588 ^{129.085}	7 05 55.36 ^{582.02}
12	20 53 15.272 ^{139.194}	13 51 44.03 ^{429.03}	12	22 40 12.497 ^{128.909}	6 56 11.49 ^{583.87}
13	20 55 34.229 ^{138.957}	13 44 30.39 ^{433.64}	13	22 42 21.231 ^{128.734}	6 46 25.83 ^{585.66}
14	20 57 52.950 ^{138.721}	13 37 12.18 ^{438.21}	14	22 44 29.792 ^{128.561}	6 36 38.43 ^{587.40}
15	21 00 11.434 ^{138.484}	13 29 49.47 ^{442.71}	15	22 46 38.183 ^{128.391}	6 26 49.35 ^{589.08}
16	21 02 29.682 ^{138.248}	13 22 22.31 ^{447.16}	16	22 48 46.406 ^{128.223}	6 16 58.65 ^{590.70}
17	21 04 47.695 ^{138.013}	13 14 50.77 ^{451.54}	17	22 50 54.462 ^{128.056}	6 07 06.39 ^{592.26}
18	21 07 05.472 ^{137.777}	13 07 14.90 ^{455.87}	18	22 53 02.354 ^{127.892}	5 57 12.61 ^{593.78}
19	21 09 23.014 ^{137.542}	12 59 34.76 ^{460.14}	19	22 55 10.085 ^{127.731}	5 47 17.38 ^{595.23}
20	21 11 40.321 ^{137.307}	12 51 50.42 ^{464.34}	20	22 57 17.656 ^{127.571}	5 37 20.75 ^{596.63}
21	21 13 57.395 ^{137.074}	12 44 01.93 ^{468.49}	21	22 59 25.069 ^{127.413}	5 27 22.78 ^{597.97}
22	21 16 14.235 ^{136.840}	12 36 09.35 ^{472.58}	22	23 01 32.327 ^{127.258}	5 17 23.52 ^{599.26}
23	21 18 30.842 ^{136.607}	12 28 12.74 ^{476.61}	23	23 03 39.432 ^{127.105}	5 07 23.02 ^{600.50}
24	21 20 47.218 ^{136.376}	-12 20 12.17 ^{+480.57}	24	23 05 46.386 ^{126.954}	-4 57 21.35 ^{+601.67}

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 22			April 24		
h	h m s	° ' "	h	h m s	° ' "
0	23 05 46.386	126.806	0	0 45 07.068	122.310
1	23 07 53.192	126.660	1	0 47 09.378	122.268
2	23 09 59.852	126.515	2	0 49 11.646	122.229
3	23 12 06.367	126.373	3	0 51 13.875	122.192
4	23 14 12.740	126.234	4	0 53 16.067	122.156
5	23 16 18.974	126.097	5	0 55 18.223	122.122
6	23 18 25.071	125.961	6	0 57 20.345	122.090
7	23 20 31.032	125.829	7	0 59 22.435	122.060
8	23 22 36.861	125.699	8	1 01 24.495	122.031
9	23 24 42.560	125.570	9	1 03 26.526	122.005
10	23 26 48.130	125.444	10	1 05 28.531	121.980
11	23 28 53.574	125.320	11	1 07 30.511	121.957
12	23 30 58.894	125.200	12	1 09 32.468	121.936
13	23 33 04.094	125.080	13	1 11 34.404	121.916
14	23 35 09.174	124.963	14	1 13 36.320	121.899
15	23 37 14.137	124.849	15	1 15 38.219	121.882
16	23 39 18.986	124.736	16	1 17 40.101	121.867
17	23 41 23.722	124.627	17	1 19 41.968	121.855
18	23 43 28.349	124.519	18	1 21 43.823	121.843
19	23 45 32.868	124.413	19	1 23 45.666	121.833
20	23 47 37.281	124.311	20	1 25 47.499	121.826
21	23 49 41.592	124.209	21	1 27 49.325	121.818
22	23 51 45.801	124.111	22	1 29 51.143	121.813
23	23 53 49.912	124.014	23	1 31 52.956	121.810
April 23			April 25		
0	23 55 53.926	123.921	0	1 33 54.766	121.808
1	23 57 57.847	123.828	1	1 35 56.574	121.806
2	0 00 01.675	123.739	2	1 37 58.380	121.808
3	0 02 05.414	123.652	3	1 40 00.188	121.809
4	0 04 09.066	123.566	4	1 42 01.997	121.813
5	0 06 12.632	123.483	5	1 44 03.810	121.817
6	0 08 16.115	123.403	6	1 46 05.627	121.824
7	0 10 19.518	123.323	7	1 48 07.451	121.831
8	0 12 22.841	123.248	8	1 50 09.282	121.840
9	0 14 26.089	123.173	9	1 52 11.122	121.849
10	0 16 29.262	123.101	10	1 54 12.971	121.861
11	0 18 32.363	123.031	11	1 56 14.832	121.873
12	0 20 35.394	122.963	12	1 58 16.705	121.887
13	0 22 38.357	122.897	13	2 00 18.592	121.901
14	0 24 41.254	122.834	14	2 02 20.493	121.917
15	0 26 44.088	122.772	15	2 04 22.410	121.934
16	0 28 46.860	122.712	16	2 06 24.344	121.951
17	0 30 49.572	122.656	17	2 08 26.295	121.971
18	0 32 52.228	122.600	18	2 10 28.266	121.990
19	0 34 54.828	122.546	19	2 12 30.256	122.012
20	0 36 57.374	122.496	20	2 14 32.268	122.033
21	0 38 59.870	122.446	21	2 16 34.301	122.056
22	0 41 02.316	122.398	22	2 18 36.357	122.080
23	0 43 04.714	122.354	23	2 20 38.437	122.105
24	0 45 07.068	122.310	24	2 22 40.542	122.130

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
April 26							April 28						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	2 22	40.542	^s	+10 29	20.05	+484.86	0	4 01	00.755	^s	+15 47	16.34	+295.65
1	2 24	42.672	122.130	10 37	24.91	481.61	1	4 03	04.566	123.811	15 52	11.99	291.12
2	2 26	44.828	122.156	10 45	26.52	478.33	2	4 05	08.411	123.845	15 57	03.11	286.55
3	2 28	47.011	122.183	10 53	24.85	475.01	3	4 07	12.289	123.878	16 01	49.66	281.99
4	2 30	49.222	122.211	11 01	19.86	471.66	4	4 09	16.200	123.911	16 06	31.65	277.33
5	2 32	51.462	122.240	11 09	11.52	468.27	5	4 11	20.143	123.943	16 11	09.03	272.78
6	2 34	53.730	122.268	11 16	59.79	464.86	6	4 13	24.119	123.976	16 15	41.81	268.15
7	2 36	56.029	122.299	11 24	44.65	461.40	7	4 15	28.126	124.007	16 20	09.96	263.50
8	2 38	58.359	122.330	11 32	26.05	457.93	8	4 17	32.163	124.037	16 24	33.46	258.84
9	2 41	00.719	122.360	11 40	03.98	454.41	9	4 19	36.231	124.068	16 28	52.30	254.15
10	2 43	03.112	122.393	11 47	38.39	450.86	10	4 21	40.328	124.097	16 33	06.45	249.47
11	2 45	05.537	122.425	11 55	09.25	447.29	11	4 23	44.455	124.127	16 37	15.92	244.75
12	2 47	07.994	122.457	12 02	36.54	443.68	12	4 25	48.610	124.155	16 41	20.67	240.03
13	2 49	10.486	122.492	12 10	00.22	440.04	13	4 27	52.793	124.183	16 45	20.70	235.29
14	2 51	13.011	122.525	12 17	20.26	436.36	14	4 29	57.002	124.209	16 49	15.99	230.53
15	2 53	15.571	122.560	12 24	36.62	432.67	15	4 32	01.239	124.237	16 53	06.52	225.76
16	2 55	18.165	122.594	12 31	49.29	428.94	16	4 34	05.501	124.262	16 56	52.28	220.98
17	2 57	20.795	122.630	12 38	58.23	425.18	17	4 36	09.788	124.287	17 00	33.26	216.18
18	2 59	23.460	122.665	12 46	03.41	421.39	18	4 38	14.099	124.311	17 04	09.44	211.38
19	3 01	26.162	122.702	12 53	04.80	417.57	19	4 40	18.434	124.335	17 07	40.82	206.55
20	3 03	28.899	122.737	13 00	02.37	413.73	20	4 42	22.792	124.358	17 11	07.37	201.71
21	3 05	31.674	122.775	13 06	56.10	409.85	21	4 44	27.172	124.380	17 14	29.08	196.87
22	3 07	34.485	122.811	13 13	45.95	405.95	22	4 46	31.573	124.401	17 17	45.95	192.01
23	3 09	37.333	122.848	+13 20	31.90	+402.01	23	4 48	35.995	124.422	+17 20	57.96	+187.14
			122.885							124.441			
April 27							April 29						
0	3 11	40.218	122.923	+13 27	13.91	+398.06	0	4 50	40.436	124.461	+17 24	05.10	+182.26
1	3 13	43.141	122.961	13 33	51.97	394.07	1	4 52	44.897	124.478	17 27	07.36	177.37
2	3 15	46.102	122.999	13 40	26.04	390.06	2	4 54	49.375	124.496	17 30	04.73	172.47
3	3 17	49.101	123.036	13 46	56.10	386.02	3	4 56	53.871	124.512	17 32	57.20	167.55
4	3 19	52.137	123.074	13 53	22.12	381.95	4	4 58	58.383	124.528	17 35	44.75	162.64
5	3 21	55.211	123.113	13 59	44.07	377.87	5	5 01	02.911	124.542	17 38	27.39	157.70
6	3 23	58.324	123.150	14 06	01.94	373.74	6	5 03	07.453	124.557	17 41	05.09	152.77
7	3 26	01.474	123.189	14 12	15.68	369.61	7	5 05	12.010	124.569	17 43	37.86	147.81
8	3 28	04.663	123.226	14 18	25.29	365.43	8	5 07	16.579	124.581	17 46	05.67	142.87
9	3 30	07.889	123.265	14 24	30.72	361.25	9	5 09	21.160	124.593	17 48	28.54	137.90
10	3 32	11.154	123.302	14 30	31.97	357.03	10	5 11	25.753	124.602	17 50	46.44	132.92
11	3 34	14.456	123.340	14 36	29.00	352.79	11	5 13	30.355	124.612	17 52	59.36	127.95
12	3 36	17.796	123.378	14 42	21.79	348.53	12	5 15	34.967	124.621	17 55	07.31	122.97
13	3 38	21.174	123.415	14 48	10.32	344.24	13	5 17	39.588	124.628	17 57	10.28	117.97
14	3 40	24.589	123.453	14 53	54.56	339.93	14	5 19	44.216	124.635	17 59	08.25	112.98
15	3 42	28.042	123.490	14 59	34.49	335.60	15	5 21	48.851	124.640	18 01	01.23	107.97
16	3 44	31.532	123.526	15 05	10.09	331.24	16	5 23	53.491	124.645	18 02	49.20	102.97
17	3 46	35.058	123.564	15 10	41.33	326.87	17	5 25	58.136	124.649	18 04	32.17	97.95
18	3 48	38.622	123.600	15 16	08.20	322.47	18	5 28	02.785	124.652	18 06	10.12	92.94
19	3 50	42.222	123.635	15 21	30.67	318.06	19	5 30	07.437	124.654	18 07	43.06	87.91
20	3 52	45.857	123.672	15 26	48.73	313.61	20	5 32	12.091	124.655	18 09	10.97	82.89
21	3 54	49.529	123.707	15 32	02.34	309.15	21	5 34	16.746	124.656	18 10	33.86	77.86
22	3 56	53.236	123.742	15 37	11.49	304.68	22	5 36	21.402	124.654	18 11	51.72	72.82
23	3 58	56.978	123.777	15 42	16.17	+300.17	23	5 38	26.056	124.653	18 13	04.54	+67.79
24	4 01	00.755		+15 47	16.34		24	5 40	30.709		+18 14	12.33	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 30			May 2		
h	h m s	° ' "	h	h m s	° ' "
0	5 40 30.709	+18 14 12.33	0	7 19 55.786	+17 30 02.94
1	5 42 35.359	18 15 15.08	1	7 21 59.404	17 27 06.67
2	5 44 40.006	18 16 12.79	2	7 24 02.988	17 24 05.59
3	5 46 44.648	18 17 05.45	3	7 26 06.538	17 20 59.71
4	5 48 49.285	18 17 53.07	4	7 28 10.053	17 17 49.05
5	5 50 53.916	18 18 35.64	5	7 30 13.533	17 14 33.61
6	5 52 58.540	18 19 13.17	6	7 32 16.979	17 11 13.41
7	5 55 03.156	18 19 45.65	7	7 34 20.390	17 07 48.46
8	5 57 07.762	18 20 13.08	8	7 36 23.766	17 04 18.78
9	5 59 12.359	18 20 35.46	9	7 38 27.107	17 00 44.36
10	6 01 16.945	18 20 52.79	10	7 40 30.413	16 57 05.24
11	6 03 21.520	18 21 05.08	11	7 42 33.685	16 53 21.41
12	6 05 26.082	18 21 12.32	12	7 44 36.922	16 49 32.90
13	6 07 30.631	18 21 14.51	13	7 46 40.124	16 45 39.71
14	6 09 35.166	18 21 11.66	14	7 48 43.291	16 41 41.87
15	6 11 39.685	18 21 03.77	15	7 50 46.424	16 37 39.37
16	6 13 44.189	18 20 50.83	16	7 52 49.523	16 33 32.25
17	6 15 48.677	18 20 32.86	17	7 54 52.588	16 29 20.50
18	6 17 53.147	18 20 09.86	18	7 56 55.619	16 25 04.15
19	6 19 57.598	18 19 41.82	19	7 58 58.616	16 20 43.21
20	6 22 02.031	18 19 08.75	20	8 01 01.580	16 16 17.69
21	6 24 06.444	18 18 30.66	21	8 03 04.512	16 11 47.61
22	6 26 10.837	18 17 47.54	22	8 05 07.410	16 07 12.99
23	6 28 15.208	+18 16 59.41	23	8 07 10.276	+16 02 33.83
May 1			May 3		
0	6 30 19.558	+18 16 06.27	0	8 09 13.110	+15 57 50.16
1	6 32 23.884	18 15 08.11	1	8 11 15.913	15 53 01.98
2	6 34 28.188	18 14 04.95	2	8 13 18.685	15 48 09.33
3	6 36 32.467	18 12 56.80	3	8 15 21.426	15 43 12.20
4	6 38 36.722	18 11 43.65	4	8 17 24.137	15 38 10.62
5	6 40 40.951	18 10 25.51	5	8 19 26.819	15 33 04.61
6	6 42 45.155	18 09 02.40	6	8 21 29.472	15 27 54.17
7	6 44 49.332	18 07 34.31	7	8 23 32.096	15 22 39.34
8	6 46 53.482	18 06 01.25	8	8 25 34.693	15 17 20.11
9	6 48 57.604	18 04 23.22	9	8 27 37.262	15 11 56.52
10	6 51 01.698	18 02 40.25	10	8 29 39.805	15 06 28.58
11	6 53 05.763	18 00 52.33	11	8 31 42.323	15 00 56.30
12	6 55 09.799	17 58 59.46	12	8 33 44.815	14 55 19.70
13	6 57 13.805	17 57 01.67	13	8 35 47.283	14 49 38.81
14	6 59 17.781	17 54 58.95	14	8 37 49.728	14 43 53.63
15	7 01 21.726	17 52 51.32	15	8 39 52.151	14 38 04.19
16	7 03 25.640	17 50 38.78	16	8 41 54.551	14 32 10.51
17	7 05 29.522	17 48 21.34	17	8 43 56.931	14 26 12.60
18	7 07 33.373	17 45 59.02	18	8 45 59.291	14 20 10.49
19	7 09 37.191	17 43 31.81	19	8 48 01.631	14 14 04.18
20	7 11 40.976	17 40 59.74	20	8 50 03.954	14 07 53.71
21	7 13 44.729	17 38 22.81	21	8 52 06.260	14 01 39.09
22	7 15 48.448	17 35 41.02	22	8 54 08.549	13 55 20.33
23	7 17 52.134	17 32 54.40	23	8 56 10.824	13 48 57.47
24	7 19 55.786	+17 30 02.94	24	8 58 13.085	+13 42 30.51

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 4			May 6		
h	h m s	° ' "	h	h m s	° ' "
0	8 58 13.085 ^s 122.248	+13 42 30.51 ^s -391.02	0	10 36 13.071 ^s 123.448	+7 20 11.61 ^s -558.23
1	9 00 15.333 ^s 122.236	13 35 59.49 395.08	1	10 38 16.519 ^s 123.521	7 10 53.38 561.01
2	9 02 17.569 ^s 122.226	13 29 24.41 399.10	2	10 40 20.040 ^s 123.595	7 01 32.37 563.75
3	9 04 19.795 ^s 122.216	13 22 45.31 403.12	3	10 42 23.635 ^s 123.673	6 52 08.62 566.48
4	9 06 22.011 ^s 122.209	13 16 02.19 407.10	4	10 44 27.308 ^s 123.751	6 42 42.14 569.15
5	9 08 24.220 ^s 122.201	13 09 15.09 411.07	5	10 46 31.059 ^s 123.834	6 33 12.99 571.79
6	9 10 26.421 ^s 122.196	13 02 24.02 415.02	6	10 48 34.893 ^s 123.918	6 23 41.20 574.41
7	9 12 28.617 ^s 122.192	12 55 29.00 418.94	7	10 50 38.811 ^s 124.004	6 14 06.79 576.97
8	9 14 30.809 ^s 122.189	12 48 30.06 422.84	8	10 52 42.815 ^s 124.093	6 04 29.82 579.51
9	9 16 32.998 ^s 122.187	12 41 27.22 426.72	9	10 54 46.908 ^s 124.184	5 54 50.31 582.02
10	9 18 35.185 ^s 122.187	12 34 20.50 430.58	10	10 56 51.092 ^s 124.278	5 45 08.29 584.47
11	9 20 37.372 ^s 122.188	12 27 09.92 434.42	11	10 58 55.370 ^s 124.373	5 35 23.82 586.89
12	9 22 39.560 ^s 122.191	12 19 55.50 438.23	12	11 00 59.743 ^s 124.473	5 25 36.93 589.28
13	9 24 41.751 ^s 122.195	12 12 37.27 442.02	13	11 03 04.216 ^s 124.573	5 15 47.65 591.63
14	9 26 43.946 ^s 122.200	12 05 15.25 445.78	14	11 05 08.789 ^s 124.676	5 05 56.02 593.93
15	9 28 46.146 ^s 122.207	11 57 49.47 449.53	15	11 07 13.465 ^s 124.782	4 56 02.09 596.20
16	9 30 48.353 ^s 122.217	11 50 19.94 453.26	16	11 09 18.247 ^s 124.891	4 46 05.89 598.43
17	9 32 50.570 ^s 122.226	11 42 46.68 456.94	17	11 11 23.138 ^s 125.001	4 36 07.46 600.61
18	9 34 52.796 ^s 122.238	11 35 09.74 460.62	18	11 13 28.139 ^s 125.115	4 26 06.85 602.75
19	9 36 55.034 ^s 122.251	11 27 29.12 464.27	19	11 15 33.254 ^s 125.231	4 16 04.10 604.86
20	9 38 57.285 ^s 122.267	11 19 44.85 467.89	20	11 17 38.485 ^s 125.349	4 05 59.24 606.92
21	9 40 59.552 ^s 122.283	11 11 56.96 471.49	21	11 19 43.834 ^s 125.469	3 55 52.32 608.94
22	9 43 01.835 ^s 122.302	11 04 05.47 475.06	22	11 21 49.303 ^s 125.593	3 45 43.38 610.92
23	9 45 04.137 ^s 122.321	+10 56 10.41 -478.61	23	11 23 54.896 ^s 125.720	+3 35 32.46 -612.84
May 5			May 7		
0	9 47 06.458 ^s 122.344	+10 48 11.80 -482.13	0	11 26 00.616 ^s 125.847	+3 25 19.62 -614.74
1	9 49 08.802 ^s 122.367	10 40 09.67 485.63	1	11 28 06.463 ^s 125.979	3 15 04.88 616.57
2	9 51 11.169 ^s 122.392	10 32 04.04 489.10	2	11 30 12.442 ^s 126.112	3 04 48.31 618.37
3	9 53 13.561 ^s 122.420	10 23 54.94 492.55	3	11 32 18.554 ^s 126.249	2 54 29.94 620.12
4	9 55 15.981 ^s 122.449	10 15 42.39 495.96	4	11 34 24.803 ^s 126.387	2 44 09.82 621.83
5	9 57 18.430 ^s 122.479	10 07 26.43 499.35	5	11 36 31.190 ^s 126.529	2 33 47.99 623.49
6	9 59 20.909 ^s 122.512	9 59 07.08 502.71	6	11 38 37.719 ^s 126.673	2 23 24.50 625.09
7	10 01 23.421 ^s 122.547	9 50 44.37 506.05	7	11 40 44.392 ^s 126.819	2 12 59.41 626.66
8	10 03 25.968 ^s 122.584	9 42 18.32 509.36	8	11 42 51.211 ^s 126.969	2 02 32.75 628.17
9	10 05 28.552 ^s 122.622	9 33 48.96 512.64	9	11 44 58.180 ^s 127.120	1 52 04.58 629.64
10	10 07 31.174 ^s 122.663	9 25 16.32 515.89	10	11 47 05.300 ^s 127.274	1 41 34.94 631.05
11	10 09 33.837 ^s 122.705	9 16 40.43 519.11	11	11 49 12.574 ^s 127.432	1 31 03.89 632.41
12	10 11 36.542 ^s 122.749	9 08 01.32 522.30	12	11 51 20.006 ^s 127.591	1 20 31.48 633.73
13	10 13 39.291 ^s 122.796	8 59 19.02 525.47	13	11 53 27.597 ^s 127.753	1 09 57.75 634.99
14	10 15 42.087 ^s 122.845	8 50 33.55 528.60	14	11 55 35.350 ^s 127.917	0 59 22.76 636.20
15	10 17 44.932 ^s 122.896	8 41 44.95 531.70	15	11 57 43.267 ^s 128.086	0 48 46.56 637.36
16	10 19 47.828 ^s 122.948	8 32 53.25 534.78	16	11 59 51.353 ^s 128.254	0 38 09.20 638.46
17	10 21 50.776 ^s 123.003	8 23 58.47 537.82	17	12 01 59.607 ^s 128.428	0 27 30.74 639.51
18	10 23 53.779 ^s 123.060	8 15 00.65 540.83	18	12 04 08.035 ^s 128.602	0 16 51.23 640.51
19	10 25 56.839 ^s 123.119	8 05 59.82 543.81	19	12 06 16.637 ^s 128.780	+0 06 10.72 641.45
20	10 27 59.958 ^s 123.181	7 56 56.01 546.76	20	12 08 25.417 ^s 128.961	-0 04 30.73 642.33
21	10 30 03.139 ^s 123.244	7 47 49.25 549.68	21	12 10 34.378 ^s 129.143	0 15 13.06 643.16
22	10 32 06.383 ^s 123.310	7 38 39.57 552.55	22	12 12 43.521 ^s 129.328	0 25 56.22 643.93
23	10 34 09.693 ^s 123.378	7 29 27.02 555.41	23	12 14 52.849 ^s 129.516	0 36 40.15 644.65
24	10 36 13.071 ^s 123.448	+7 20 11.61 ^s -558.23	24	12 17 02.365 ^s 129.710	-0 47 24.80 -646.41

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
May 8							May 10						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	12	17	02.365	129.707	-	0 47 24.80	0	14	05	04.824	141.349	-	9 15 46.59
1	12	19	12.072	129.899		0 58 10.11	1	14	07	26.173	141.627		9 25 43.14
2	12	21	21.971	130.095		1 08 56.01	2	14	09	47.800	141.905		9 35 36.79
3	12	23	32.066	130.293		1 19 42.45	3	14	12	09.705	142.185		9 45 27.45
4	12	25	42.359	130.493		1 30 29.36	4	14	14	31.890	142.464		9 55 15.04
5	12	27	52.852	130.696		1 41 16.70	5	14	16	54.354	142.744	10	04 59.47
6	12	30	03.548	130.901		1 52 04.39	6	14	19	17.098	143.024	10	14 40.65
7	12	32	14.449	131.109		2 02 52.37	7	14	21	40.122	143.303	10	24 18.50
8	12	34	25.558	131.319		2 13 40.58	8	14	24	03.425	143.583	10	33 52.94
9	12	36	36.877	131.532		2 24 28.97	9	14	26	27.008	143.863	10	43 23.88
10	12	38	48.409	131.746		2 35 17.46	10	14	28	50.871	144.143	10	52 51.24
11	12	41	00.155	131.964		2 46 05.99	11	14	31	15.014	144.421	11	02 14.93
12	12	43	12.119	132.183		2 56 54.49	12	14	33	39.435	144.701	11	11 34.87
13	12	45	24.302	132.406		3 07 42.90	13	14	36	04.136	144.979	11	20 50.96
14	12	47	36.708	132.629		3 18 31.16	14	14	38	29.115	145.257	11	30 03.14
15	12	49	49.337	132.856		3 29 19.19	15	14	40	54.372	145.534	11	39 11.30
16	12	52	02.193	133.085		3 40 06.93	16	14	43	19.906	145.811	11	48 15.37
17	12	54	15.278	133.316		3 50 54.31	17	14	45	45.717	146.086	11	57 15.26
18	12	56	28.594	133.548		4 01 41.27	18	14	48	11.803	146.360	12	06 10.89
19	12	58	42.142	133.784		4 12 27.72	19	14	50	38.163	146.635	12	15 02.17
20	13	00	55.926	134.022		4 23 13.61	20	14	53	04.798	146.906	12	23 49.02
21	13	03	09.948	134.260		4 33 58.87	21	14	55	31.704	147.178	12	32 31.35
22	13	05	24.208	134.502		4 44 43.41	22	14	57	58.882	147.448	12	41 09.08
23	13	07	38.710	134.746	-	4 55 27.17	23	15	00	26.330	147.716	-12	49 42.12
May 9							May 11						
0	13	09	53.456	134.991	-	5 06 10.08	0	15	02	54.046	147.983	-12	58 10.40
1	13	12	08.447	135.238		5 16 52.06	1	15	05	22.029	148.249		13 06 33.83
2	13	14	23.685	135.487		5 27 33.05	2	15	07	50.278	148.511		13 14 52.33
3	13	16	39.172	135.739		5 38 12.96	3	15	10	18.789	148.773		13 23 05.81
4	13	18	54.911	135.991		5 48 51.72	4	15	12	47.562	149.033		13 31 14.19
5	13	21	10.902	136.246		5 59 29.26	5	15	15	16.595	149.290		13 39 17.40
6	13	23	27.148	136.503		6 10 05.50	6	15	17	45.885	149.545		13 47 15.34
7	13	25	43.651	136.760		6 20 40.37	7	15	20	15.430	149.798		13 55 07.95
8	13	28	00.411	137.020		6 31 13.79	8	15	22	45.228	150.048		14 02 55.14
9	13	30	17.431	137.282		6 41 45.67	9	15	25	15.276	150.297		14 10 36.83
10	13	32	34.713	137.544		6 52 15.95	10	15	27	45.573	150.541		14 18 12.95
11	13	34	52.257	137.808		7 02 44.55	11	15	30	16.114	150.784		14 25 43.41
12	13	37	10.065	138.074		7 13 11.38	12	15	32	46.898	151.024		14 33 08.14
13	13	39	28.139	138.341		7 23 36.37	13	15	35	17.922	151.261		14 40 27.06
14	13	41	46.480	138.609		7 33 59.44	14	15	37	49.183	151.494		14 47 40.10
15	13	44	05.089	138.878		7 44 20.50	15	15	40	20.677	151.725		14 54 47.18
16	13	46	23.967	139.149		7 54 39.48	16	15	42	52.402	151.951		15 01 48.23
17	13	48	43.116	139.421		8 04 56.30	17	15	45	24.353	152.176		15 08 43.17
18	13	51	02.537	139.694		8 15 10.87	18	15	47	56.529	152.395		15 15 31.94
19	13	53	22.231	139.968		8 25 23.12	19	15	50	28.924	152.612		15 22 14.46
20	13	55	42.199	140.242		8 35 32.96	20	15	53	01.536	152.825		15 28 50.66
21	13	58	02.441	140.518		8 45 40.31	21	15	55	34.361	153.034		15 35 20.47
22	14	00	22.959	140.794		8 55 45.09	22	15	58	07.395	153.239		15 41 43.82
23	14	02	43.753	141.071		9 05 47.21	23	16	00	40.634	153.439		15 48 00.65
24	14	05	04.824		-	9 15 46.59	24	16	03	14.073		-15	54 10.89

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
May 12									May 14								
h	h	m	s	°	'	"	h	m	s	h	h	m	s	°	'	"	
0	16	03	14.073	153.637	-15	54 10.89	0	18	08 14.724	156.681	-18	25 16.39	156.681	18	25 16.39	156.681	
1	16	05	47.710	153.829	16	00 14.48	1	18	10 51.405	156.595	18	25 12.14	156.595	18	25 12.14	156.595	
2	16	08	21.539	154.017	16	06 11.35	2	18	13 28.000	156.501	18	24 59.90	156.501	18	24 59.90	156.501	
3	16	10	55.556	154.201	16	12 01.43	3	18	16 04.501	156.403	18	24 39.67	156.403	18	24 39.67	156.403	
4	16	13	29.757	154.381	16	17 44.67	4	18	18 40.904	156.298	18	24 11.47	156.298	18	24 11.47	156.298	
5	16	16	04.138	154.554	16	23 21.01	5	18	21 17.202	156.186	18	23 35.31	156.186	18	23 35.31	156.186	
6	16	18	38.692	154.725	16	28 50.38	6	18	23 53.388	156.070	18	22 51.23	156.070	18	22 51.23	156.070	
7	16	21	13.417	154.889	16	34 12.74	7	18	26 29.458	155.948	18	21 59.23	155.948	18	21 59.23	155.948	
8	16	23	48.306	155.050	16	39 28.01	8	18	29 05.406	155.819	18	20 59.35	155.819	18	20 59.35	155.819	
9	16	26	23.356	155.204	16	44 36.16	9	18	31 41.225	155.685	18	19 51.60	155.685	18	19 51.60	155.685	
10	16	28	58.560	155.354	16	49 37.12	10	18	34 16.910	155.545	18	18 36.01	155.545	18	18 36.01	155.545	
11	16	31	33.914	155.499	16	54 30.84	11	18	36 52.455	155.400	18	17 12.62	155.400	18	17 12.62	155.400	
12	16	34	09.413	155.639	16	59 17.27	12	18	39 27.855	155.249	18	15 41.44	155.249	18	15 41.44	155.249	
13	16	36	45.052	155.772	17	03 56.37	13	18	42 03.104	155.093	18	14 02.51	155.093	18	14 02.51	155.093	
14	16	39	20.824	155.901	17	08 28.08	14	18	44 38.197	154.931	18	12 15.86	154.931	18	12 15.86	154.931	
15	16	41	56.725	156.024	17	12 52.36	15	18	47 13.128	154.764	18	10 21.53	154.764	18	10 21.53	154.764	
16	16	44	32.749	156.142	17	17 09.16	16	18	49 47.892	154.593	18	08 19.54	154.593	18	08 19.54	154.593	
17	16	47	08.891	156.254	17	21 18.44	17	18	52 22.485	154.415	18	06 09.94	154.415	18	06 09.94	154.415	
18	16	49	45.145	156.359	17	25 20.16	18	18	54 56.900	154.233	18	03 52.75	154.233	18	03 52.75	154.233	
19	16	52	21.504	156.460	17	29 14.27	19	18	57 31.133	154.047	18	01 28.03	154.047	18	01 28.03	154.047	
20	16	54	57.964	156.555	17	33 00.75	20	19	00 05.180	153.854	17	58 55.81	153.854	17	58 55.81	153.854	
21	16	57	34.519	156.643	17	36 39.54	21	19	02 39.034	153.658	17	56 16.13	153.658	17	56 16.13	153.658	
22	17	00	11.162	156.726	17	40 10.63	22	19	05 12.692	153.457	17	53 29.04	153.457	17	53 29.04	153.457	
23	17	02	47.888	156.803	-17	43 33.96	23	19	07 46.149	153.250	-17	50 34.57	153.250	-17	50 34.57	153.250	
May 13									May 15								
0	17	05	24.691	156.873	-17	46 49.52	0	19	10 19.399	153.041	-17	47 32.78	153.041	-17	47 32.78	153.041	
1	17	08	01.564	156.937	17	49 57.27	1	19	12 52.440	152.827	17	44 23.70	152.827	17	44 23.70	152.827	
2	17	10	38.501	156.996	17	52 57.18	2	19	15 25.267	152.607	17	41 07.39	152.607	17	41 07.39	152.607	
3	17	13	15.497	157.048	17	55 49.23	3	19	17 57.874	152.385	17	37 43.89	152.385	17	37 43.89	152.385	
4	17	15	52.545	157.094	17	58 33.39	4	19	20 30.259	152.158	17	34 13.25	152.158	17	34 13.25	152.158	
5	17	18	29.639	157.134	18	01 09.63	5	19	23 02.417	151.928	17	30 35.53	151.928	17	30 35.53	151.928	
6	17	21	06.773	157.167	18	03 37.94	6	19	25 34.345	151.692	17	26 50.77	151.692	17	26 50.77	151.692	
7	17	23	43.940	157.194	18	05 58.29	7	19	28 06.037	151.455	17	22 59.02	151.455	17	22 59.02	151.455	
8	17	26	21.134	157.215	18	08 10.67	8	19	30 37.492	151.213	17	19 00.35	151.213	17	19 00.35	151.213	
9	17	28	58.349	157.229	18	10 15.06	9	19	33 08.705	150.967	17	14 54.80	150.967	17	14 54.80	150.967	
10	17	31	35.578	157.237	18	12 11.45	10	19	35 39.672	150.719	17	10 42.43	150.719	17	10 42.43	150.719	
11	17	34	12.815	157.239	18	13 59.82	11	19	38 10.391	150.467	17	06 23.30	150.467	17	06 23.30	150.467	
12	17	36	50.054	157.234	18	15 40.16	12	19	40 40.858	150.212	17	01 57.45	150.212	17	01 57.45	150.212	
13	17	39	27.288	157.223	18	17 12.47	13	19	43 11.070	149.953	16	57 24.95	149.953	16	57 24.95	149.953	
14	17	42	04.511	157.205	18	18 36.73	14	19	45 41.023	149.693	16	52 45.86	149.693	16	52 45.86	149.693	
15	17	44	41.716	157.181	18	19 52.93	15	19	48 10.716	149.429	16	48 00.24	149.429	16	48 00.24	149.429	
16	17	47	18.897	157.151	18	21 01.08	16	19	50 40.145	149.162	16	43 08.14	149.162	16	43 08.14	149.162	
17	17	49	56.048	157.114	18	22 01.18	17	19	53 09.307	148.894	16	38 09.63	148.894	16	38 09.63	148.894	
18	17	52	33.162	157.072	18	22 53.21	18	19	55 38.201	148.622	16	33 04.77	148.622	16	33 04.77	148.622	
19	17	55	10.234	157.022	18	23 37.19	19	19	58 06.823	148.348	16	27 53.61	148.348	16	27 53.61	148.348	
20	17	57	47.256	156.966	18	24 13.12	20	20	00 35.171	148.071	16	22 36.22	148.071	16	22 36.22	148.071	
21	18	00	24.222	156.904	18	24 40.99	21	20	03 03.242	147.794	16	17 12.67	147.794	16	17 12.67	147.794	
22	18	03	01.126	156.837	18	25 00.82	22	20	05 31.036	147.513	16	11 43.01	147.513	16	11 43.01	147.513	
23	18	05	37.963	156.761	18	25 12.62	23	20	07 58.549	147.231	16	06 07.32	147.231	16	06 07.32	147.231	
24	18	08	14.724		-18	25 16.39	24	20	10 25.780		-16	00 25.65		-16	00 25.65		

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
May 16							May 18						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	20	10	25.780	146.947	146.662	-16 00 25.65	0	22	02	28.957	133.108	-9 51 54.73	+552.06
1	20	12	52.727	146.662	146.374	15 54 38.06	1	22	04	42.065	132.848	9 42 42.67	554.69
2	20	15	19.389	146.374	146.086	15 48 44.64	2	22	06	54.913	132.590	9 33 27.98	557.26
3	20	17	45.763	146.086	145.795	15 42 45.43	3	22	09	07.503	132.334	9 24 10.72	559.78
4	20	20	11.849	145.795	145.504	15 36 40.51	4	22	11	19.837	132.081	9 14 50.94	562.22
5	20	22	37.644	145.504	145.212	15 30 29.94	5	22	13	31.918	131.830	9 05 28.72	564.60
6	20	25	03.148	145.212	144.918	15 24 13.78	6	22	15	43.748	131.581	8 56 04.12	566.93
7	20	27	28.360	144.918	144.624	15 17 52.12	7	22	17	55.329	131.334	8 46 37.19	569.20
8	20	29	53.278	144.624	144.328	15 11 25.00	8	22	20	06.663	131.090	8 37 07.99	571.39
9	20	32	17.902	144.328	144.032	15 04 52.51	9	22	22	17.753	130.848	8 27 36.60	573.54
10	20	34	42.230	144.032	143.736	14 58 14.70	10	22	24	28.601	130.609	8 18 03.06	575.62
11	20	37	06.262	143.736	143.439	14 51 31.65	11	22	26	39.210	130.373	8 08 27.44	577.64
12	20	39	29.998	143.439	143.141	14 44 43.43	12	22	28	49.583	130.137	7 58 49.80	579.60
13	20	41	53.437	143.141	142.842	14 37 50.09	13	22	30	59.720	129.907	7 49 10.20	581.51
14	20	44	16.578	142.842	142.545	14 30 51.71	14	22	33	09.627	129.676	7 39 28.69	583.35
15	20	46	39.420	142.545	142.246	14 23 48.36	15	22	35	19.303	129.451	7 29 45.34	585.14
16	20	49	01.965	142.246	141.948	14 16 40.11	16	22	37	28.754	129.226	7 20 00.20	586.87
17	20	51	24.211	141.948	141.650	14 09 27.02	17	22	39	37.980	129.005	7 10 13.33	588.54
18	20	53	46.159	141.650	141.351	14 02 09.17	18	22	41	46.985	128.786	7 00 24.79	590.15
19	20	56	07.809	141.351	141.053	13 54 46.62	19	22	43	55.771	128.570	6 50 34.64	591.70
20	20	58	29.160	141.053	140.756	13 47 19.43	20	22	46	04.341	128.357	6 40 42.94	593.21
21	21	00	50.213	140.756	140.458	13 39 47.69	21	22	48	12.698	128.146	6 30 49.73	594.65
22	21	03	10.969	140.458	140.161	13 32 11.46	22	22	50	20.844	127.938	6 20 55.08	596.04
23	21	05	31.427	140.161		-13 24 30.80	23	22	52	28.782	127.733	-6 10 59.04	+597.37
						+465.02							
May 17							May 19						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	21	07	51.588	139.865	139.570	-13 16 45.78	0	22	54	36.515	127.531	-6 01 01.67	+598.64
1	21	10	11.453	139.570	139.274	13 08 56.48	1	22	56	44.046	127.331	5 51 03.03	599.87
2	21	12	31.023	139.274	138.980	13 01 02.97	2	22	58	51.377	127.135	5 41 03.16	601.03
3	21	14	50.297	138.980	138.687	12 53 05.30	3	23	00	58.512	126.940	5 31 02.13	602.15
4	21	17	09.277	138.687	138.395	12 45 03.55	4	23	03	05.452	126.750	5 20 59.98	603.20
5	21	19	27.964	138.395	138.103	12 36 57.78	5	23	05	12.202	126.560	5 10 56.78	604.21
6	21	21	46.359	138.103	137.813	12 28 48.07	6	23	07	18.762	126.376	5 00 52.57	605.16
7	21	24	04.462	137.813	137.524	12 20 34.49	7	23	09	25.138	126.193	4 50 47.41	606.06
8	21	26	22.275	137.524	137.236	12 12 17.09	8	23	11	31.331	126.012	4 40 41.35	606.90
9	21	28	39.799	137.236	136.949	12 03 55.94	9	23	13	37.343	125.836	4 30 34.45	607.70
10	21	30	57.035	136.949	136.665	11 55 31.12	10	23	15	43.179	125.662	4 20 26.75	608.44
11	21	33	13.984	136.665	136.380	11 47 02.70	11	23	17	48.841	125.491	4 10 18.31	609.12
12	21	35	30.649	136.380	136.099	11 38 30.72	12	23	19	54.332	125.322	4 00 09.19	609.77
13	21	37	47.029	136.099	135.817	11 29 55.28	13	23	21	59.654	125.157	3 49 59.42	610.35
14	21	40	03.128	135.817	135.539	11 21 16.42	14	23	24	04.811	124.994	3 39 49.07	610.88
15	21	42	18.945	135.539	135.261	11 12 34.22	15	23	26	09.805	124.835	3 29 38.19	611.37
16	21	44	34.484	135.261	134.986	11 03 48.74	16	23	28	14.640	124.677	3 19 26.82	611.81
17	21	46	49.745	134.986	134.711	10 55 00.05	17	23	30	19.317	124.524	3 09 15.01	612.19
18	21	49	04.731	134.711	134.440	10 46 08.21	18	23	32	23.841	124.373	2 59 02.82	612.53
19	21	51	19.442	134.440	134.169	10 37 13.29	19	23	34	28.214	124.225	2 48 50.29	612.81
20	21	53	33.882	134.169	133.901	10 28 15.36	20	23	36	32.439	124.079	2 38 37.48	613.05
21	21	55	48.051	133.901	133.634	10 19 14.47	21	23	38	36.518	123.937	2 28 24.43	613.24
22	21	58	01.952	133.634	133.371	10 10 10.69	22	23	40	40.455	123.797	2 18 11.19	613.37
23	22	00	15.586	133.371		10 01 04.09	23	23	42	44.252	123.661	2 07 57.82	+613.47
24	22	02	28.957			-9 51 54.73	24	23	44	47.913		-1 57 44.35	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 20			May 22		
h	h m s	° ' "	h	h m s	° ' "
0	23 44 47.913 ^s	- 1 57 44.35 ^s	0	1 21 56.766 ^s	+ 6 00 03.54 ^s
1	23 46 51.440 ^s	1 47 30.84 ^s	1	1 23 57.019 ^s	6 09 27.23 ^s
2	23 48 54.836 ^s	1 37 17.34 ^s	2	1 25 57.262 ^s	6 18 48.87 ^s
3	23 50 58.104 ^s	1 27 03.88 ^s	3	1 27 57.497 ^s	6 28 08.44 ^s
4	23 53 01.246 ^s	1 16 50.53 ^s	4	1 29 57.727 ^s	6 37 25.90 ^s
5	23 55 04.267 ^s	1 06 37.32 ^s	5	1 31 57.953 ^s	6 46 41.20 ^s
6	23 57 07.167 ^s	0 56 24.31 ^s	6	1 33 58.177 ^s	6 55 54.32 ^s
7	23 59 09.951 ^s	0 46 11.53 ^s	7	1 35 58.401 ^s	7 05 05.21 ^s
8	0 01 12.622 ^s	0 35 59.04 ^s	8	1 37 58.628 ^s	7 14 13.83 ^s
9	0 03 15.181 ^s	0 25 46.89 ^s	9	1 39 58.858 ^s	7 23 20.16 ^s
10	0 05 17.631 ^s	0 15 35.11 ^s	10	1 41 59.094 ^s	7 32 24.14 ^s
11	0 07 19.977 ^s	- 0 05 23.75 ^s	11	1 43 59.337 ^s	7 41 25.76 ^s
12	0 09 22.219 ^s	+ 0 04 47.14 ^s	12	1 45 59.589 ^s	7 50 24.96 ^s
13	0 11 24.362 ^s	0 14 57.52 ^s	13	1 47 59.853 ^s	7 59 21.71 ^s
14	0 13 26.407 ^s	0 25 07.34 ^s	14	1 50 00.129 ^s	8 08 15.98 ^s
15	0 15 28.358 ^s	0 35 16.55 ^s	15	1 52 00.420 ^s	8 17 07.73 ^s
16	0 17 30.217 ^s	0 45 25.12 ^s	16	1 54 00.727 ^s	8 25 56.93 ^s
17	0 19 31.988 ^s	0 55 33.00 ^s	17	1 56 01.051 ^s	8 34 43.53 ^s
18	0 21 33.672 ^s	1 05 40.15 ^s	18	1 58 01.395 ^s	8 43 27.51 ^s
19	0 23 35.272 ^s	1 15 46.52 ^s	19	2 00 01.759 ^s	8 52 08.83 ^s
20	0 25 36.791 ^s	1 25 52.06 ^s	20	2 02 02.146 ^s	9 00 47.44 ^s
21	0 27 38.232 ^s	1 35 56.74 ^s	21	2 04 02.557 ^s	9 09 23.33 ^s
22	0 29 39.598 ^s	1 46 00.52 ^s	22	2 06 02.993 ^s	9 17 56.44 ^s
23	0 31 40.890 ^s	+ 1 56 03.34 ^s	23	2 08 03.455 ^s	+ 9 26 26.75 ^s
	121.222	+601.83		120.491	+507.48
May 21			May 23		
0	0 33 42.112 ^s	+ 2 06 05.17 ^s	0	2 10 03.946 ^s	+ 9 34 54.23 ^s
1	0 35 43.266 ^s	2 16 05.96 ^s	1	2 12 04.467 ^s	9 43 18.83 ^s
2	0 37 44.355 ^s	2 26 05.67 ^s	2	2 14 05.018 ^s	9 51 40.53 ^s
3	0 39 45.381 ^s	2 36 04.27 ^s	3	2 16 05.601 ^s	9 59 59.28 ^s
4	0 41 46.347 ^s	2 46 01.70 ^s	4	2 18 06.218 ^s	10 08 15.07 ^s
5	0 43 47.255 ^s	2 55 57.93 ^s	5	2 20 06.870 ^s	10 16 27.84 ^s
6	0 45 48.109 ^s	3 05 52.92 ^s	6	2 22 07.557 ^s	10 24 37.57 ^s
7	0 47 48.909 ^s	3 15 46.62 ^s	7	2 24 08.281 ^s	10 32 44.22 ^s
8	0 49 49.660 ^s	3 25 38.99 ^s	8	2 26 09.044 ^s	10 40 47.77 ^s
9	0 51 50.362 ^s	3 35 29.99 ^s	9	2 28 09.846 ^s	10 48 48.17 ^s
10	0 53 51.020 ^s	3 45 19.59 ^s	10	2 30 10.689 ^s	10 56 45.40 ^s
11	0 55 51.634 ^s	3 55 07.73 ^s	11	2 32 11.572 ^s	11 04 39.43 ^s
12	0 57 52.208 ^s	4 04 54.38 ^s	12	2 34 12.499 ^s	11 12 30.21 ^s
13	0 59 52.744 ^s	4 14 39.51 ^s	13	2 36 13.469 ^s	11 20 17.71 ^s
14	1 01 53.243 ^s	4 24 23.06 ^s	14	2 38 14.483 ^s	11 28 01.92 ^s
15	1 03 53.710 ^s	4 34 05.01 ^s	15	2 40 15.542 ^s	11 35 42.78 ^s
16	1 05 54.145 ^s	4 43 45.30 ^s	16	2 42 16.648 ^s	11 43 20.28 ^s
17	1 07 54.551 ^s	4 53 23.90 ^s	17	2 44 17.800 ^s	11 50 54.38 ^s
18	1 09 54.930 ^s	5 03 00.78 ^s	18	2 46 19.001 ^s	11 58 25.04 ^s
19	1 11 55.285 ^s	5 12 35.89 ^s	19	2 48 20.250 ^s	12 05 52.24 ^s
20	1 13 55.617 ^s	5 22 09.19 ^s	20	2 50 21.548 ^s	12 13 15.95 ^s
21	1 15 55.929 ^s	5 31 40.64 ^s	21	2 52 22.896 ^s	12 20 36.13 ^s
22	1 17 56.223 ^s	5 41 10.21 ^s	22	2 54 24.295 ^s	12 27 52.76 ^s
23	1 19 56.502 ^s	5 50 37.86 ^s	23	2 56 25.746 ^s	12 35 05.79 ^s
24	1 21 56.766 ^s	+ 6 00 03.54 ^s	24	2 58 27.248 ^s	+12 42 15.22 ^s
	120.264	+565.68		121.502	+429.43

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
May 24									May 26										
h	h	m	s		°	'	"		h	h	m	s		°	'	"			
0	2	58	27.248	^s	+12	42	15.22	["]	0	4	36	43.559	^s	+17	06	04.39	["]		
1	3	00	28.803	121.555		12	49	21.00	+425.78	1	4	38	47.631	124.072		17	09	44.92	+220.53
2	3	02	30.410	121.607		12	56	23.10	422.10	2	4	40	51.742	124.111		17	13	20.68	215.76
3	3	04	32.072	121.662		13	03	21.49	418.39	3	4	42	55.892	124.150		17	16	51.63	210.95
4	3	06	33.787	121.715		13	10	16.15	414.66	4	4	45	00.079	124.187		17	20	17.78	206.15
5	3	08	35.556	121.769		13	17	07.05	410.90	5	4	47	04.303	124.224		17	23	39.09	201.31
6	3	10	37.381	121.825		13	23	54.15	407.10	6	4	49	08.563	124.260		17	26	55.57	196.48
7	3	12	39.260	121.879		13	30	37.43	403.28	7	4	51	12.856	124.293		17	30	07.19	191.62
8	3	14	41.195	121.935		13	37	16.86	399.43	8	4	53	17.183	124.327		17	33	13.94	186.75
9	3	16	43.186	121.991		13	43	52.42	395.56	9	4	55	21.543	124.360		17	36	15.81	181.87
10	3	18	45.233	122.047		13	50	24.07	391.65	10	4	57	25.933	124.390		17	39	12.79	176.98
11	3	20	47.336	122.103		13	56	51.78	387.71	11	4	59	30.353	124.420		17	42	04.86	172.07
12	3	22	49.495	122.159		14	03	15.53	383.75	12	5	01	34.802	124.449		17	44	52.02	167.16
13	3	24	51.711	122.216		14	09	35.30	379.77	13	5	03	39.279	124.477		17	47	34.24	162.22
14	3	26	53.983	122.272		14	15	51.05	375.75	14	5	05	43.782	124.503		17	50	11.53	157.29
15	3	28	56.313	122.330		14	22	02.76	371.71	15	5	07	48.310	124.528		17	52	43.87	152.34
16	3	30	58.699	122.386		14	28	10.40	367.64	16	5	09	52.862	124.552		17	55	11.25	147.38
17	3	33	01.141	122.442		14	34	13.94	363.54	17	5	11	57.437	124.575		17	57	33.66	142.41
18	3	35	03.641	122.500		14	40	13.37	359.43	18	5	14	02.034	124.597		17	59	51.09	137.43
19	3	37	06.197	122.556		14	46	08.65	355.28	19	5	16	06.651	124.617		18	02	03.53	132.44
20	3	39	08.810	122.613		14	51	59.76	351.11	20	5	18	11.287	124.636		18	04	10.98	127.45
21	3	41	11.479	122.669		14	57	46.68	346.92	21	5	20	15.940	124.653		18	06	13.43	122.45
22	3	43	14.205	122.726		15	03	29.37	342.69	22	5	22	20.610	124.670		18	08	10.86	117.43
23	3	45	16.986	122.781		+15	09	07.82	338.45	23	5	24	25.295	124.685		+18	10	03.27	112.41
				122.838					+334.18				124.699						+107.39
May 25									May 27										
0	3	47	19.824	122.893		+15	14	42.00	+329.89	0	5	26	29.994	124.711		+18	11	50.66	+102.35
1	3	49	22.717	122.949		15	20	11.89	325.57	1	5	28	34.705	124.723		18	13	33.01	97.32
2	3	51	25.666	123.003		15	25	37.46	321.23	2	5	30	39.428	124.733		18	15	10.33	92.27
3	3	53	28.669	123.058		15	30	58.69	316.87	3	5	32	44.161	124.741		18	16	42.60	87.22
4	3	55	31.727	123.113		15	36	15.56	312.49	4	5	34	48.902	124.748		18	18	09.82	82.16
5	3	57	34.840	123.166		15	41	28.05	308.07	5	5	36	53.650	124.754		18	19	31.98	77.11
6	3	59	38.006	123.220		15	46	36.12	303.65	6	5	38	58.404	124.758		18	20	49.09	72.04
7	4	01	41.226	123.273		15	51	39.77	299.20	7	5	41	03.162	124.762		18	22	01.13	66.98
8	4	03	44.499	123.325		15	56	38.97	294.72	8	5	43	07.924	124.764		18	23	08.11	61.91
9	4	05	47.824	123.377		16	01	33.69	290.24	9	5	45	12.688	124.764		18	24	10.02	56.83
10	4	07	51.201	123.428		16	06	23.93	285.71	10	5	47	17.452	124.763		18	25	06.85	51.76
11	4	09	54.629	123.479		16	11	09.64	281.19	11	5	49	22.215	124.760		18	25	58.61	46.68
12	4	11	58.108	123.530		16	15	50.83	276.62	12	5	51	26.975	124.760		18	26	45.29	41.60
13	4	14	01.638	123.578		16	20	27.45	272.06	13	5	53	31.732	124.757		18	27	26.89	36.52
14	4	16	05.216	123.628		16	24	59.51	267.46	14	5	55	36.485	124.753		18	28	03.41	31.43
15	4	18	08.844	123.675		16	29	26.97	262.85	15	5	57	41.230	124.745		18	28	34.84	26.35
16	4	20	12.519	123.723		16	33	49.82	258.21	16	5	59	45.969	124.739		18	29	01.19	21.28
17	4	22	16.242	123.769		16	38	08.03	253.57	17	6	01	50.698	124.729		18	29	22.47	16.18
18	4	24	20.011	123.816		16	42	21.60	248.90	18	6	03	55.417	124.719		18	29	38.65	11.11
19	4	26	23.827	123.860		16	46	30.50	244.22	19	6	06	00.124	124.707		18	29	49.76	6.02
20	4	28	27.687	123.904		16	50	34.72	239.51	20	6	08	04.818	124.694		18	29	55.78	+ 0.95
21	4	30	31.591	123.947		16	54	34.23	234.79	21	6	10	09.498	124.680		18	29	56.73	- 4.14
22	4	32	35.538	123.990		16	58	29.02	230.06	22	6	12	14.163	124.665		18	29	52.59	9.21
23	4	34	39.528	124.031		17	02	19.08	+225.31	23	6	14	18.810	124.647		18	29	43.38	- 14.28
24	4	36	43.559			+17	06	04.39		24	6	16	23.440	124.630		+18	29	29.10	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
May 28							May 30						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	6	16	23.440	124.609	+18	29 29.10	0	7	55	23.107	122.532	+16	40 51.64
1	6	18	28.049	124.590	18	29 09.74	1	7	57	25.639	122.475	16	36 38.81
2	6	20	32.639	124.567	18	28 45.32	2	7	59	28.114	122.419	16	32 21.44
3	6	22	37.206	124.544	18	28 15.83	3	8	01	30.533	122.361	16	27 59.55
4	6	24	41.750	124.519	18	27 41.28	4	8	03	32.894	122.305	16	23 33.16
5	6	26	46.269	124.494	18	27 01.68	5	8	05	35.199	122.248	16	19 02.28
6	6	28	50.763	124.467	18	26 17.02	6	8	07	37.447	122.191	16	14 26.94
7	6	30	55.230	124.439	18	25 27.32	7	8	09	39.638	122.134	16	09 47.16
8	6	32	59.669	124.410	18	24 32.58	8	8	11	41.772	122.078	16	05 02.94
9	6	35	04.079	124.379	18	23 32.80	9	8	13	43.850	122.022	16	00 14.31
10	6	37	08.458	124.348	18	22 28.00	10	8	15	45.872	121.966	15	55 21.29
11	6	39	12.806	124.315	18	21 18.17	11	8	17	47.838	121.910	15	50 23.90
12	6	41	17.121	124.281	18	20 03.32	12	8	19	49.748	121.854	15	45 22.16
13	6	43	21.402	124.247	18	18 43.47	13	8	21	51.602	121.800	15	40 16.08
14	6	45	25.649	124.211	18	17 18.62	14	8	23	53.402	121.744	15	35 05.69
15	6	47	29.860	124.173	18	15 48.77	15	8	25	55.146	121.691	15	29 51.00
16	6	49	34.033	124.136	18	14 13.94	16	8	27	56.837	121.636	15	24 32.04
17	6	51	38.169	124.097	18	12 34.13	17	8	29	58.473	121.583	15	19 08.82
18	6	53	42.266	124.057	18	10 49.35	18	8	32	00.056	121.531	15	13 41.37
19	6	55	46.323	124.016	18	08 59.61	19	8	34	01.587	121.477	15	08 09.71
20	6	57	50.339	123.974	18	07 04.93	20	8	36	03.064	121.426	15	02 33.85
21	6	59	54.313	123.932	18	05 05.30	21	8	38	04.490	121.375	14	56 53.82
22	7	01	58.245	123.888	18	03 00.75	22	8	40	05.865	121.325	14	51 09.64
23	7	04	02.133	123.843	+18	00 51.27	23	8	42	07.190	121.274	+14	45 21.33
May 29							May 31						
0	7	06	05.976	123.798	+17	58 36.89	0	8	44	08.464	121.226	+14	39 28.91
1	7	08	09.774	123.752	17	56 17.60	1	8	46	09.690	121.177	14	33 32.40
2	7	10	13.526	123.705	17	53 53.43	2	8	48	10.867	121.130	14	27 31.82
3	7	12	17.231	123.657	17	51 24.39	3	8	50	11.997	121.082	14	21 27.20
4	7	14	20.888	123.609	17	48 50.48	4	8	52	13.079	121.038	14	15 18.56
5	7	16	24.497	123.560	17	46 11.72	5	8	54	14.117	120.992	14	09 05.92
6	7	18	28.057	123.510	17	43 28.12	6	8	56	15.109	120.948	14	02 49.30
7	7	20	31.567	123.460	17	40 39.70	7	8	58	16.057	120.905	13	56 28.72
8	7	22	35.027	123.408	17	37 46.46	8	9	00	16.962	120.864	13	50 04.21
9	7	24	38.435	123.357	17	34 48.42	9	9	02	17.826	120.822	13	43 35.78
10	7	26	41.792	123.305	17	31 45.60	10	9	04	18.648	120.782	13	37 03.47
11	7	28	45.097	123.252	17	28 38.00	11	9	06	19.430	120.744	13	30 27.29
12	7	30	48.349	123.198	17	25 25.64	12	9	08	20.174	120.706	13	23 47.27
13	7	32	51.547	123.145	17	22 08.54	13	9	10	20.880	120.669	13	17 03.43
14	7	34	54.692	123.091	17	18 46.71	14	9	12	21.549	120.635	13	10 15.80
15	7	36	57.783	123.036	17	15 20.17	15	9	14	22.184	120.600	13	03 24.39
16	7	39	00.819	122.982	17	11 48.92	16	9	16	22.784	120.567	12	56 29.23
17	7	41	03.801	122.926	17	08 12.99	17	9	18	23.351	120.537	12	49 30.34
18	7	43	06.727	122.870	17	04 32.39	18	9	20	23.888	120.506	12	42 27.76
19	7	45	09.597	122.815	17	00 47.14	19	9	22	24.394	120.477	12	35 21.49
20	7	47	12.412	122.758	16	56 57.25	20	9	24	24.871	120.450	12	28 11.57
21	7	49	15.170	122.702	16	53 02.74	21	9	26	25.321	120.425	12	20 58.02
22	7	51	17.872	122.646	16	49 03.62	22	9	28	25.746	120.400	12	13 40.87
23	7	53	20.518	122.589	16	44 59.91	23	9	30	26.146	120.377	12	06 20.13
24	7	55	23.107		+16	40 51.64	24	9	32	26.523		+11	58 55.84

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 1			June 3		
h	h m s	° ' " S	h	h m s	° ' " S
0	9 32 26.523 ^s	+ 11 58 55.84 ["]	0	11 08 54.895 ^s	+ 5 02 32.83 ["]
1	9 34 26.879 ^s	120.356 ["] II 51 28.02 ["]	1	11 10 56.616 ^s	4 52 48.11 ["]
2	9 36 27.215 ^s	120.336 ["] II 43 56.69 ["]	2	11 12 58.427 ^s	4 43 01.31 ["]
3	9 38 27.533 ^s	120.318 ["] II 36 21.88 ["]	3	11 15 00.329 ^s	4 33 12.46 ["]
4	9 40 27.835 ^s	120.302 ["] II 28 43.62 ["]	4	11 17 02.325 ^s	4 23 21.59 ["]
5	9 42 28.121 ^s	120.286 ["] II 21 01.92 ["]	5	11 19 04.418 ^s	4 13 28.76 ["]
6	9 44 28.395 ^s	120.274 ["] II 13 16.82 ["]	6	11 21 06.612 ^s	4 03 33.98 ["]
7	9 46 28.657 ^s	120.262 ["] II 05 28.34 ["]	7	11 23 08.909 ^s	3 53 37.30 ["]
8	9 48 28.910 ^s	120.253 ["] 10 57 36.51 ["]	8	11 25 11.311 ^s	3 43 38.76 ["]
9	9 50 29.155 ^s	120.245 ["] 10 49 41.35 ["]	9	11 27 13.823 ^s	3 33 38.40 ["]
10	9 52 29.394 ^s	120.239 ["] 10 41 42.89 ["]	10	11 29 16.446 ^s	3 23 36.25 ["]
11	9 54 29.628 ^s	120.234 ["] 10 33 41.15 ["]	11	11 31 19.185 ^s	3 13 32.35 ["]
12	9 56 29.861 ^s	120.233 ["] 10 25 36.17 ["]	12	11 33 22.041 ^s	3 03 26.74 ["]
13	9 58 30.093 ^s	120.232 ["] 10 17 27.96 ["]	13	11 35 25.017 ^s	2 53 19.46 ["]
14	10 00 30.327 ^s	120.234 ["] 10 09 16.56 ["]	14	11 37 28.118 ^s	2 43 10.56 ["]
15	10 02 30.564 ^s	120.237 ["] 10 01 02.00 ["]	15	11 39 31.345 ^s	2 33 00.07 ["]
16	10 04 30.807 ^s	120.243 ["] 9 52 44.29 ["]	16	11 41 34.701 ^s	2 22 48.03 ["]
17	10 06 31.057 ^s	120.250 ["] 9 44 23.47 ["]	17	11 43 38.191 ^s	2 12 34.48 ["]
18	10 08 31.317 ^s	120.260 ["] 9 35 59.56 ["]	18	11 45 41.816 ^s	2 02 19.47 ["]
19	10 10 31.589 ^s	120.272 ["] 9 27 32.60 ["]	19	11 47 45.581 ^s	1 52 03.04 ["]
20	10 12 31.874 ^s	120.285 ["] 9 19 02.60 ["]	20	11 49 49.487 ^s	1 41 45.23 ["]
21	10 14 32.176 ^s	120.302 ["] 9 10 29.61 ["]	21	11 51 53.538 ^s	1 31 26.08 ["]
22	10 16 32.496 ^s	120.320 ["] 9 01 53.64 ["]	22	11 53 57.737 ^s	1 21 05.65 ["]
23	10 18 32.836 ^s	120.340 ["] + 8 53 14.73 ["]	23	11 56 02.087 ^s	+ 1 10 43.96 ["]
	120.363 ["]	-521.83 ["]		124.504 ["]	-622.89 ["]
June 2			June 4		
0	10 20 33.199 ^s	+ 8 44 32.90 ["]	0	11 58 06.591 ^s	+ 1 00 21.07 ["]
1	10 22 33.586 ^s	120.387 ["] 8 35 48.19 ["]	1	12 00 11.253 ^s	0 49 57.03 ["]
2	10 24 34.001 ^s	120.415 ["] 8 27 00.61 ["]	2	12 02 16.075 ^s	0 39 31.87 ["]
3	10 26 34.445 ^s	120.444 ["] 8 18 10.21 ["]	3	12 04 21.061 ^s	0 29 05.64 ["]
4	10 28 34.921 ^s	120.476 ["] 8 09 17.01 ["]	4	12 06 26.213 ^s	0 18 38.40 ["]
5	10 30 35.430 ^s	120.509 ["] 8 00 21.04 ["]	5	12 08 31.535 ^s	+ 0 08 10.18 ["]
6	10 32 35.977 ^s	120.547 ["] 7 51 22.33 ["]	6	12 10 37.030 ^s	- 0 02 18.97 ["]
7	10 34 36.562 ^s	120.585 ["] 7 42 20.91 ["]	7	12 12 42.700 ^s	0 12 48.99 ["]
8	10 36 37.188 ^s	120.626 ["] 7 33 16.81 ["]	8	12 14 48.550 ^s	0 23 19.84 ["]
9	10 38 37.858 ^s	120.670 ["] 7 24 10.07 ["]	9	12 16 54.582 ^s	0 33 51.46 ["]
10	10 40 38.575 ^s	120.717 ["] 7 15 00.71 ["]	10	12 19 00.799 ^s	0 44 23.82 ["]
11	10 42 39.340 ^s	120.765 ["] 7 05 48.76 ["]	11	12 21 07.205 ^s	0 54 56.86 ["]
12	10 44 40.156 ^s	120.816 ["] 6 56 34.26 ["]	12	12 23 13.802 ^s	0 54 56.86 ["]
13	10 46 41.026 ^s	120.870 ["] 6 47 17.23 ["]	13	12 25 20.594 ^s	1 05 30.52 ["]
14	10 48 41.953 ^s	120.927 ["] 6 37 57.72 ["]	14	12 27 27.584 ^s	1 16 04.76 ["]
15	10 50 42.938 ^s	120.985 ["] 6 28 35.75 ["]	15	12 29 34.774 ^s	1 26 39.52 ["]
16	10 52 43.985 ^s	121.047 ["] 6 19 11.35 ["]	16	12 31 42.168 ^s	1 37 14.76 ["]
17	10 54 45.096 ^s	121.111 ["] 6 09 44.56 ["]	17	12 33 49.770 ^s	1 47 50.42 ["]
18	10 56 46.274 ^s	121.178 ["] 6 00 15.40 ["]	18	12 35 57.581 ^s	1 58 26.44 ["]
19	10 58 47.521 ^s	121.247 ["] 5 50 43.93 ["]	19	12 38 05.606 ^s	2 09 02.77 ["]
20	11 00 48.841 ^s	121.320 ["] 5 41 10.15 ["]	20	12 40 13.847 ^s	2 19 39.35 ["]
21	11 02 50.235 ^s	121.394 ["] 5 31 34.12 ["]	21	12 42 22.307 ^s	2 30 16.14 ["]
22	11 04 51.707 ^s	121.472 ["] 5 21 55.87 ["]	22	12 44 30.990 ^s	2 40 53.07 ["]
23	11 06 53.259 ^s	121.552 ["] 5 12 15.43 ["]	23	12 46 39.898 ^s	2 51 30.09 ["]
24	11 08 54.895 ^s	121.636 ["] + 5 02 32.83 ["]	24	12 48 49.035 ^s	3 02 07.14 ["]
		-582.60 ["]		129.137 ["]	- 3 12 44.16 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
June 5							June 7						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	12	48	49.035	129.368	-3	12 44.16	0	14	37	28.384	143.362	-11	20 14.16
1	12	50	58.403	129.602	3	23 21.09	1	14	39	51.746	143.692	11	29 25.81
2	12	53	08.005	129.840	3	33 57.88	2	14	42	15.438	144.023	11	38 33.75
3	12	55	17.845	130.080	3	44 34.46	3	14	44	39.461	144.352	11	47 37.91
4	12	57	27.925	130.323	3	55 10.77	4	14	47	03.813	144.683	11	56 38.21
5	12	59	38.248	130.569	4	05 46.76	5	14	49	28.496	145.013	12	05 34.55
6	13	01	48.817	130.819	4	16 22.36	6	14	51	53.509	145.343	12	14 26.85
7	13	03	59.636	131.070	4	26 57.50	7	14	54	18.852	145.673	12	23 15.02
8	13	06	10.706	131.325	4	37 32.14	8	14	56	44.525	146.003	12	31 58.98
9	13	08	22.031	131.583	4	48 06.19	9	14	59	10.528	146.331	12	40 38.64
10	13	10	33.614	131.843	4	58 39.60	10	15	01	36.859	146.661	12	49 13.92
11	13	12	45.457	132.106	5	09 12.30	11	15	04	03.520	146.987	12	57 44.72
12	13	14	57.563	132.372	5	19 44.23	12	15	06	30.507	147.315	13	06 10.96
13	13	17	09.935	132.640	5	30 15.32	13	15	08	57.822	147.641	13	14 32.56
14	13	19	22.575	132.911	5	40 45.50	14	15	11	25.463	147.966	13	22 49.43
15	13	21	35.486	133.185	5	51 14.71	15	15	13	53.429	148.289	13	31 01.48
16	13	23	48.671	133.462	6	01 42.88	16	15	16	21.718	148.612	13	39 08.62
17	13	26	02.133	133.740	6	12 09.94	17	15	18	50.330	148.933	13	47 10.78
18	13	28	15.873	134.022	6	22 35.81	18	15	21	19.263	149.253	13	55 07.86
19	13	30	29.895	134.306	6	33 00.44	19	15	23	48.516	149.570	14	02 59.77
20	13	32	44.201	134.592	6	43 23.74	20	15	26	18.086	149.886	14	10 46.44
21	13	34	58.793	134.881	6	53 45.65	21	15	28	47.972	150.201	14	18 27.78
22	13	37	13.674	135.172	7	04 06.10	22	15	31	18.173	150.512	14	26 03.70
23	13	39	28.846	135.465	-7	14 25.01	23	15	33	48.685	150.821	-14	33 34.12
June 6							June 8						
0	13	41	44.311	135.760	-7	24 42.31	0	15	36	19.506	151.130	-14	40 58.96
1	13	44	00.071	136.058	7	34 57.92	1	15	38	50.636	151.434	14	48 18.13
2	13	46	16.129	136.358	7	45 11.78	2	15	41	22.070	151.736	14	55 31.55
3	13	48	32.487	136.661	7	55 23.80	3	15	43	53.806	152.036	15	02 39.13
4	13	50	49.148	136.964	8	05 33.92	4	15	46	25.842	152.333	15	09 40.80
5	13	53	06.112	137.269	8	15 42.04	5	15	48	58.175	152.626	15	16 36.47
6	13	55	23.381	137.578	8	25 48.11	6	15	51	30.801	152.917	15	23 26.07
7	13	57	40.959	137.888	8	35 52.04	7	15	54	03.718	153.204	15	30 09.51
8	13	59	58.847	138.198	8	45 53.75	8	15	56	36.922	153.487	15	36 46.71
9	14	02	17.045	138.512	8	55 53.17	9	15	59	10.409	153.769	15	43 17.59
10	14	04	35.557	138.827	9	05 50.21	10	16	01	44.178	154.044	15	49 42.09
11	14	06	54.384	139.143	9	15 44.80	11	16	04	18.222	154.318	15	56 00.11
12	14	09	13.527	139.461	9	25 36.85	12	16	06	52.540	154.586	16	02 11.59
13	14	11	32.988	139.780	9	35 26.29	13	16	09	27.126	154.851	16	08 16.45
14	14	13	52.768	140.101	9	45 13.04	14	16	12	01.977	155.111	16	14 14.62
15	14	16	12.869	140.423	9	54 57.00	15	16	14	37.088	155.367	16	20 06.02
16	14	18	33.292	140.745	10	04 38.12	16	16	17	12.455	155.619	16	25 50.58
17	14	20	54.037	141.070	10	14 16.29	17	16	19	48.074	155.866	16	31 28.22
18	14	23	15.107	141.395	10	23 51.43	18	16	22	23.940	156.109	16	36 58.89
19	14	25	36.502	141.721	10	33 23.48	19	16	25	00.049	156.345	16	42 22.51
20	14	27	58.223	142.048	10	42 52.33	20	16	27	36.394	156.578	16	47 39.02
21	14	30	20.271	142.376	10	52 17.91	21	16	30	12.972	156.805	16	52 48.34
22	14	32	42.647	142.704	11	01 40.13	22	16	32	49.777	157.027	16	57 50.41
23	14	35	05.351	143.033	11	10 58.91	23	16	35	26.804	157.243	17	02 45.18
24	14	37	28.384		-11	20 14.16	24	16	38	04.047		-17	07 32.57

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
June 9							June 11						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	16	38	04.047	157.455	-17	07 32.57	0	18	45	57.994	159.555	-18	19 35.25
1	16	40	41.502	157.660	17	12 12.52	1	18	48	37.549	159.419	18	17 41.14
2	16	43	19.162	157.860	17	16 44.99	2	18	51	16.968	159.278	18	15 38.83
3	16	45	57.022	158.053	17	21 09.90	3	18	53	56.246	159.129	18	13 28.37
4	16	48	35.075	158.242	17	25 27.20	4	18	56	35.375	158.974	18	11 09.79
5	16	51	13.317	158.423	17	29 36.84	5	18	59	14.349	158.812	18	08 43.12
6	16	53	51.740	158.599	17	33 38.77	6	19	01	53.161	158.643	18	06 08.41
7	16	56	30.339	158.768	17	37 32.93	7	19	04	31.804	158.469	18	03 25.69
8	16	59	09.107	158.932	17	41 19.27	8	19	07	10.273	158.288	18	00 35.02
9	17	01	48.039	159.088	17	44 57.74	9	19	09	48.561	158.100	17	57 36.42
10	17	04	27.127	159.237	17	48 28.30	10	19	12	26.661	157.907	17	54 29.95
11	17	07	06.364	159.381	17	51 50.90	11	19	15	04.568	157.708	17	51 15.66
12	17	09	45.745	159.518	17	55 05.50	12	19	17	42.276	157.503	17	47 53.59
13	17	12	25.263	159.647	17	58 12.06	13	19	20	19.779	157.292	17	44 23.80
14	17	15	04.910	159.771	18	01 10.54	14	19	22	57.071	157.075	17	40 46.33
15	17	17	44.681	159.886	18	04 00.89	15	19	25	34.146	156.853	17	37 01.24
16	17	20	24.567	159.995	18	06 43.09	16	19	28	10.999	156.626	17	33 08.58
17	17	23	04.562	160.096	18	09 17.10	17	19	30	47.625	156.394	17	29 08.41
18	17	25	44.658	160.191	18	11 42.89	18	19	33	24.019	156.155	17	25 00.78
19	17	28	24.849	160.279	18	14 00.42	19	19	36	00.174	155.913	17	20 45.76
20	17	31	05.128	160.358	18	16 09.67	20	19	38	36.087	155.665	17	16 23.41
21	17	33	45.486	160.431	18	18 10.62	21	19	41	11.752	155.412	17	11 53.78
22	17	36	25.917	160.496	18	20 03.23	22	19	43	47.164	155.155	17	07 16.93
23	17	39	06.413	160.554	-18	21 47.49	23	19	46	22.319	154.894	-17	02 32.94
June 10							June 12						
0	17	41	46.967	160.605	-18	23 23.38	0	19	48	57.213	154.628	-16	57 41.87
1	17	44	27.572	160.647	18	24 50.87	1	19	51	31.841	154.357	16	52 43.77
2	17	47	08.219	160.683	18	26 09.96	2	19	54	06.198	154.083	16	47 38.72
3	17	49	48.902	160.710	18	27 20.62	3	19	56	40.281	153.805	16	42 26.79
4	17	52	29.612	160.730	18	28 22.84	4	19	59	14.086	153.523	16	37 08.04
5	17	55	10.342	160.743	18	29 16.62	5	20	01	47.609	153.237	16	31 42.55
6	17	57	51.085	160.748	18	30 01.95	6	20	04	20.846	152.948	16	26 10.37
7	18	00	31.833	160.746	18	30 38.81	7	20	06	53.794	152.655	16	20 31.60
8	18	03	12.579	160.735	18	31 07.21	8	20	09	26.449	152.359	16	14 46.28
9	18	05	53.314	160.717	18	31 27.15	9	20	11	58.808	152.060	16	08 54.51
10	18	08	34.031	160.692	18	31 38.62	10	20	14	30.868	151.758	16	02 56.35
11	18	11	14.723	160.659	18	31 41.63	11	20	17	02.626	151.453	15	56 51.88
12	18	13	55.382	160.618	18	31 36.18	12	20	19	34.079	151.145	15	50 41.17
13	18	16	36.000	160.570	18	31 22.27	13	20	22	05.224	150.834	15	44 24.30
14	18	19	16.570	160.515	18	30 59.92	14	20	24	36.058	150.522	15	38 01.34
15	18	21	57.085	160.451	18	30 29.14	15	20	27	06.580	150.207	15	31 32.37
16	18	24	37.536	160.381	18	29 49.93	16	20	29	36.787	149.889	15	24 57.46
17	18	27	17.917	160.303	18	29 02.32	17	20	32	06.676	149.570	15	18 16.70
18	18	29	58.220	160.218	18	28 06.32	18	20	34	36.246	149.249	15	11 30.17
19	18	32	38.438	160.125	18	27 01.94	19	20	37	05.495	148.925	15	04 37.93
20	18	35	18.563	160.025	18	25 49.21	20	20	39	34.420	148.601	14	57 40.07
21	18	37	58.588	159.919	18	24 28.15	21	20	42	03.021	148.275	14	50 36.66
22	18	40	38.507	159.804	18	22 58.79	22	20	44	31.296	147.946	14	43 27.80
23	18	43	18.311	159.683	18	21 21.15	23	20	46	59.242	147.618	14	36 13.55
24	18	45	57.994		-18	19 35.25	24	20	49	26.860		-14	28 53.99

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 13			June 15		
0	h m s 20 49 26.860	— 14 28 53.99	0	h m s 22 41 07.687	— 7 19 08.09
1	147.288 20 51 54.148	14 21 29.22	1	132.093 22 43 19.780	7 09 04.20
2	146.956 20 54 21.104	14 13 59.29	2	131.822 22 45 31.602	6 58 58.77
3	146.624 20 56 47.728	14 06 24.31	3	131.554 22 47 43.156	6 48 51.86
4	146.291 20 59 14.019	13 58 44.34	4	131.289 22 49 54.445	6 38 43.54
5	145.958 21 01 39.977	13 50 59.46	5	131.027 22 52 05.472	6 28 33.87
6	145.624 21 04 05.601	13 43 09.76	6	130.767 22 54 16.239	6 18 22.91
7	145.289 21 06 30.890	13 35 15.32	7	130.510 22 56 26.749	6 08 10.72
8	144.954 21 08 55.844	13 27 16.22	8	130.257 22 58 37.006	5 57 57.36
9	144.619 21 11 20.463	13 19 12.54	9	130.006 23 00 47.012	5 47 42.91
10	144.283 21 13 44.746	13 11 04.35	10	129.758 23 02 56.770	5 37 27.41
11	143.949 21 16 08.695	13 02 51.75	11	129.513 23 05 06.283	5 27 10.93
12	143.613 21 18 32.308	12 54 34.80	12	129.272 23 07 15.555	5 16 53.53
13	143.279 21 20 55.587	12 46 13.59	13	129.032 23 09 24.587	5 06 35.26
14	142.944 21 23 18.531	12 37 48.20	14	128.797 23 11 33.384	4 56 16.19
15	142.610 21 25 41.141	12 29 18.71	15	128.565 23 13 41.949	4 45 56.37
16	142.276 21 28 03.417	12 20 45.20	16	128.335 23 15 50.284	4 35 35.86
17	141.944 21 30 25.361	12 12 07.75	17	128.108 23 17 58.392	4 25 14.72
18	141.611 21 32 46.972	12 03 26.43	18	127.885 23 20 06.277	4 14 53.00
19	141.279 21 35 08.251	11 54 41.32	19	127.665 23 22 13.942	4 04 30.76
20	140.949 21 37 29.200	11 45 52.51	20	127.448 23 24 21.390	3 54 08.06
21	140.619 21 39 49.819	11 37 00.07	21	127.234 23 26 28.624	3 43 44.95
22	140.291 21 42 10.110	11 28 04.09	22	127.023 23 28 35.647	3 33 21.49
23	139.964 21 44 30.074	— 11 19 04.62	23	126.816 23 30 42.463	— 3 22 57.72
	139.637	+ 542.85		126.612	+ 624.01
June 14			June 16		
0	h m s 21 46 49.711	— 11 10 01.77	0	h m s 23 32 49.075	— 3 12 33.71
1	139.313 21 49 09.024	11 00 55.59	1	126.410 23 34 55.485	3 02 09.50
2	138.989 21 51 28.013	10 51 46.17	2	126.212 23 37 01.697	2 51 45.15
3	138.668 21 53 46.681	10 42 33.59	3	126.018 23 39 07.715	2 41 20.72
4	138.347 21 56 05.028	10 33 17.91	4	125.826 23 41 13.541	2 30 56.24
5	138.028 21 58 23.056	10 23 59.22	5	125.637 23 43 19.178	2 20 31.78
6	137.712 22 00 40.768	10 14 37.59	6	125.453 23 45 24.631	2 10 07.38
7	137.396 22 02 58.164	10 05 13.09	7	125.270 23 47 29.901	1 59 43.10
8	137.083 22 05 15.247	9 55 45.81	8	125.092 23 49 34.993	1 49 18.98
9	136.771 22 07 32.018	9 46 15.80	9	124.916 23 51 39.909	1 38 55.07
10	136.462 22 09 48.480	9 36 43.15	10	124.744 23 53 44.653	1 28 31.43
11	136.154 22 12 04.634	9 27 07.92	11	124.574 23 55 49.227	1 18 08.10
12	135.849 22 14 20.483	9 17 30.20	12	124.409 23 57 53.636	1 07 45.13
13	135.546 22 16 36.029	9 07 50.05	13	124.246 23 59 57.882	0 57 22.56
14	135.245 22 18 51.				

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 17			June 19		
h	h m s	° ' " s	h	h m s	° ' " s
0	0 22 34.758 ^s	+ 0 56 05.56	0	1 59 09.243 ^s	+ 8 37 26.69
1	0 24 37.299 ^{122.541}	1 06 19.67 ^{+614.11}	1	2 01 09.096 ^{119.853}	8 46 10.12 ^{+523.43}
2	0 26 39.718 ^{122.419}	1 16 32.78 ^{613.11}	2	2 03 08.951 ^{119.855}	8 54 50.81 ^{520.69}
3	0 28 42.018 ^{122.300}	1 26 44.87 ^{612.09}	3	2 05 08.813 ^{119.862}	9 03 28.73 ^{517.92}
4	0 30 44.203 ^{122.185}	1 36 55.87 ^{611.00}	4	2 07 08.682 ^{119.869}	9 12 03.86 ^{515.13}
5	0 32 46.275 ^{122.072}	1 47 05.76 ^{609.89}	5	2 09 08.560 ^{119.878}	9 20 36.15 ^{512.29}
6	0 34 48.238 ^{121.963}	1 57 14.49 ^{608.73}	6	2 11 08.449 ^{119.889}	9 29 05.57 ^{509.42}
7	0 36 50.094 ^{121.856}	2 07 22.02 ^{607.53}	7	2 13 08.352 ^{119.903}	9 37 32.10 ^{506.53}
8	0 38 51.846 ^{121.752}	2 17 28.31 ^{606.29}	8	2 15 08.270 ^{119.918}	9 45 55.71 ^{503.61}
9	0 40 53.498 ^{121.652}	2 27 33.32 ^{605.01}	9	2 17 08.204 ^{119.934}	9 54 16.36 ^{500.65}
10	0 42 55.053 ^{121.555}	2 37 37.01 ^{603.69}	10	2 19 08.157 ^{119.953}	10 02 34.02 ^{497.66}
11	0 44 56.512 ^{121.459}	2 47 39.34 ^{602.33}	11	2 21 08.131 ^{119.974}	10 10 48.66 ^{494.64}
12	0 46 57.881 ^{121.369}	2 57 40.26 ^{600.92}	12	2 23 08.126 ^{119.995}	10 19 00.26 ^{491.60}
13	0 48 59.160 ^{121.279}	3 07 39.74 ^{599.48}	13	2 25 08.145 ^{120.019}	10 27 08.78 ^{488.52}
14	0 51 00.354 ^{121.194}	3 17 37.75 ^{598.01}	14	2 27 08.189 ^{120.044}	10 35 14.19 ^{485.41}
15	0 53 01.465 ^{121.111}	3 27 34.24 ^{596.49}	15	2 29 08.260 ^{120.071}	10 43 16.46 ^{482.27}
16	0 55 02.495 ^{121.030}	3 37 29.17 ^{594.93}	16	2 31 08.359 ^{120.099}	10 51 15.56 ^{479.10}
17	0 57 03.449 ^{120.954}	3 47 22.50 ^{593.33}	17	2 33 08.488 ^{120.129}	10 59 11.46 ^{475.90}
18	0 59 04.328 ^{120.879}	3 57 14.20 ^{591.70}	18	2 35 08.649 ^{120.161}	11 07 04.14 ^{472.68}
19	1 01 05.136 ^{120.808}	4 07 04.23 ^{590.03}	19	2 37 08.842 ^{120.193}	11 14 53.56 ^{469.42}
20	1 03 05.875 ^{120.739}	4 16 52.56 ^{588.33}	20	2 39 09.070 ^{120.228}	11 22 39.69 ^{466.13}
21	1 05 06.547 ^{120.672}	4 26 39.13 ^{586.57}	21	2 41 09.333 ^{120.263}	11 30 22.51 ^{462.82}
22	1 07 07.157 ^{120.610}	4 36 23.93 ^{584.80}	22	2 43 09.633 ^{120.300}	11 38 01.98 ^{459.47}
23	1 09 07.706 ^{120.549}	+ 4 46 06.90 ^{582.97}	23	2 45 09.972 ^{120.339}	+ 11 45 38.08 ^{456.10}
24		+ 581.12	24		+ 452.70
June 18			June 20		
h	h m s	° ' " s	h	h m s	° ' " s
0	1 11 08.197 ^{120.436}	+ 4 55 48.02 ^{+579.23}	0	2 47 10.350 ^{120.419}	+ 11 53 10.78 ^{+449.27}
1	1 13 08.633 ^{120.384}	5 05 27.25 ^{577.30}	1	2 49 10.769 ^{120.461}	12 00 40.05 ^{445.81}
2	1 15 09.017 ^{120.333}	5 15 04.55 ^{575.33}	2	2 51 11.230 ^{120.504}	12 08 05.86 ^{442.32}
3	1 17 09.350 ^{120.287}	5 24 39.88 ^{573.34}	3	2 53 11.734 ^{120.549}	12 15 28.18 ^{438.81}
4	1 19 09.637 ^{120.242}	5 34 13.22 ^{571.29}	4	2 55 12.283 ^{120.594}	12 22 46.99 ^{435.26}
5	1 21 09.879 ^{120.199}	5 43 44.51 ^{569.23}	5	2 57 12.877 ^{120.641}	12 30 02.25 ^{431.70}
6	1 23 10.078 ^{120.161}	5 53 13.74 ^{567.12}	6	2 59 13.518 ^{120.688}	12 37 13.95 ^{428.09}
7	1 25 10.239 ^{120.123}	6 02 40.86 ^{564.99}	7	3 01 14.206 ^{120.736}	12 44 22.04 ^{424.47}
8	1 27 10.362 ^{120.088}	6 12 05.85 ^{562.80}	8	3 03 14.942 ^{120.786}	12 51 26.51 ^{420.82}
9	1 29 10.450 ^{120.057}	6 21 28.65 ^{560.60}	9	3 05 15.728 ^{120.837}	12 58 27.33 ^{417.13}
10	1 31 10.507 ^{120.027}	6 30 49.25 ^{558.35}	10	3 07 16.565 ^{120.887}	13 05 24.46 ^{413.43}
11	1 33 10.534 ^{119.999}	6 40 07.60 ^{556.08}	11	3 09 17.452 ^{120.940}	13 12 17.89 ^{409.69}
12	1 35 10.533 ^{119.975}	6 49 23.68 ^{553.76}	12	3 11 18.392 ^{120.993}	13 19 07.58 ^{405.93}
13	1 37 10.508 ^{119.952}	6 58 37.44 ^{551.41}	13	3 13 19.385 ^{121.046}	13 25 53.51 ^{402.15}
14	1 39 10.460 ^{119.932}	7 07 48.85 ^{549.04}	14	3 15 20.431 ^{121.101}	13 32 35.66 ^{398.33}
15	1 41 10.392 ^{119.914}	7 16 57.89 ^{546.62}	15	3 17 21.532 ^{121.156}	13 39 13.99 ^{394.49}
16	1 43 10.306 ^{119.899}	7 26 04.51 ^{544.18}	16	3 19 22.688 ^{121.211}	13 45 48.48 ^{390.62}
17	1 45 10.205 ^{119.885}	7 35 08.69 ^{541.70}	17	3 21 23.899 ^{121.268}	13 52 19.10 ^{386.73}
18	1 47 10.090 ^{119.874}	7 44 10.39 ^{539.19}	18	3 23 25.167 ^{121.325}	13 58 45.83 ^{382.81}
19	1 49 09.964 ^{119.865}	7 53 09.58 ^{536.64}	19	3 25 26.492 ^{121.382}	14 05 08.64 ^{378.87}
20	1 51 09.829 ^{119.859}	8 02 06.22 ^{534.06}	20	3 27 27.874 ^{121.441}	14 11 27.51 ^{374.90}
21	1 53 09.688 ^{119.853}	8 11 00.28 ^{531.46}	21	3 29 29.315 ^{121.498}	14 17 42.41 ^{370.91}
22	1 55 09.541 ^{119.852}	8 19 51.74 ^{528.81}	22	3 31 30.813 ^{121.558}	14 23 53.32 ^{366.89}
23	1 57 09.393 ^{119.850}	8 28 40.55 ^{+526.14}	23	3 33 32.371 ^{121.617}	14 30 00.21 ^{+362.85}
24	1 59 09.243	+ 8 37 26.69	24	3 35 33.988	+ 14 36 03.06

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 21			June 23		
h	h m s	° ' " 06	h	h m s	° ' " 12
0	3 35 33.988 ^s _{121.676}	+14 36 03.06 ^s _{358.77}	0	5 13 59.718 ^s _{124.245}	+17 59 57.12 ^s _{139.39}
1	3 37 35.664 _{121.736}	14 42 01.83 _{354.69}	1	5 16 03.963 _{124.279}	18 02 16.51 _{134.44}
2	3 39 37.400 _{121.797}	14 47 56.52 _{350.57}	2	5 18 08.242 _{124.313}	18 04 30.95 _{129.47}
3	3 41 39.197 _{121.857}	14 53 47.09 _{346.43}	3	5 20 12.555 _{124.344}	18 06 40.42 _{124.50}
4	3 43 41.054 _{121.917}	14 59 33.52 _{342.26}	4	5 22 16.899 _{124.374}	18 08 44.92 _{119.51}
5	3 45 42.971 _{121.978}	15 05 15.78 _{338.08}	5	5 24 21.273 _{124.404}	18 10 44.43 _{114.51}
6	3 47 44.949 _{122.039}	15 10 53.86 _{333.87}	6	5 26 25.677 _{124.431}	18 12 38.94 _{109.52}
7	3 49 46.988 _{122.101}	15 16 27.73 _{329.63}	7	5 28 30.108 _{124.459}	18 14 28.46 _{104.50}
8	3 51 49.089 _{122.161}	15 21 57.36 _{325.38}	8	5 30 34.567 _{124.483}	18 16 12.96 _{99.49}
9	3 53 51.250 _{122.222}	15 27 22.74 _{321.09}	9	5 32 39.050 _{124.507}	18 17 52.45 _{94.46}
10	3 55 53.472 _{122.283}	15 32 43.83 _{316.80}	10	5 34 43.557 _{124.530}	18 19 26.91 _{89.43}
11	3 57 55.755 _{122.344}	15 38 00.63 _{312.47}	11	5 36 48.087 _{124.551}	18 20 56.34 _{84.38}
12	3 59 58.099 _{122.405}	15 43 13.10 _{308.13}	12	5 38 52.638 _{124.570}	18 22 20.72 _{79.35}
13	4 02 00.504 _{122.466}	15 48 21.23 _{303.76}	13	5 40 57.208 _{124.589}	18 23 40.07 _{74.29}
14	4 04 02.970 _{122.527}	15 53 24.99 _{299.36}	14	5 43 01.797 _{124.606}	18 24 54.36 _{69.23}
15	4 06 05.497 _{122.586}	15 58 24.35 _{294.96}	15	5 45 06.403 _{124.621}	18 26 03.59 _{64.17}
16	4 08 08.083 _{122.647}	16 03 19.31 _{290.53}	16	5 47 11.024 _{124.635}	18 27 07.76 _{59.11}
17	4 10 10.730 _{122.707}	16 08 09.84 _{286.08}	17	5 49 15.659 _{124.648}	18 28 06.87 _{54.03}
18	4 12 13.437 _{122.766}	16 12 55.92 _{281.60}	18	5 51 20.307 _{124.659}	18 29 00.90 _{48.96}
19	4 14 16.203 _{122.826}	16 17 37.52 _{277.11}	19	5 53 24.966 _{124.668}	18 29 49.86 _{43.88}
20	4 16 19.029 _{122.884}	16 22 14.63 _{272.60}	20	5 55 29.634 _{124.677}	18 30 33.74 _{38.80}
21	4 18 21.913 _{122.942}	16 26 47.23 _{268.07}	21	5 57 34.311 _{124.683}	18 31 12.54 _{33.72}
22	4 20 24.855 _{123.001}	16 31 15.30 _{263.52}	22	5 59 38.994 _{124.688}	18 31 46.26 _{28.63}
23	4 22 27.856 _{123.058}	+16 35 38.82 _{258.94}	23	6 01 43.682 _{124.692}	+18 32 14.89 _{23.54}
June 22			June 24		
h	h m s	° ' " 06	h	h m s	° ' " 12
0	4 24 30.914 _{123.115}	+16 39 57.76 _{254.36}	0	6 03 48.374 _{124.694}	+18 32 38.43 _{18.45}
1	4 26 34.029 _{123.171}	16 44 12.12 _{249.75}	1	6 05 53.068 _{124.695}	18 32 56.88 _{13.36}
2	4 28 37.200 _{123.227}	16 48 21.87 _{245.12}	2	6 07 57.763 _{124.694}	18 33 10.24 _{8.27}
3	4 30 40.427 _{123.282}	16 52 26.99 _{240.48}	3	6 10 02.457 _{124.692}	18 33 18.51 _{3.18}
4	4 32 43.709 _{123.337}	16 56 27.47 _{235.82}	4	6 12 07.149 _{124.688}	18 33 21.69 _{1.91}
5	4 34 47.046 _{123.391}	17 00 23.29 _{231.14}	5	6 14 11.837 _{124.682}	18 33 19.78 _{7.00}
6	4 36 50.437 _{123.444}	17 04 14.43 _{226.44}	6	6 16 16.519 _{124.676}	18 33 12.78 _{12.09}
7	4 38 53.881 _{123.496}	17 08 00.87 _{221.74}	7	6 18 21.195 _{124.668}	18 33 00.69 _{17.18}
8	4 40 57.377 _{123.547}	17 11 42.61 _{217.00}	8	6 20 25.863 _{124.657}	18 32 43.51 _{22.26}
9	4 43 00.924 _{123.599}	17 15 19.61 _{212.26}	9	6 22 30.520 _{124.646}	18 32 21.25 _{27.35}
10	4 45 04.523 _{123.648}	17 18 51.87 _{207.50}	10	6 24 35.166 _{124.634}	18 31 53.90 _{32.43}
11	4 47 08.171 _{123.698}	17 22 19.37 _{202.72}	11	6 26 39.800 _{124.619}	18 31 21.47 _{37.51}
12	4 49 11.869 _{123.746}	17 25 42.09 _{197.94}	12	6 28 44.419 _{124.604}	18 30 43.96 _{42.58}
13	4 51 15.615 _{123.793}	17 29 00.03 _{193.12}	13	6 30 49.023 _{124.586}	18 30 01.38 _{47.65}
14	4 53 19.408 _{123.839}	17 32 13.15 _{188.31}	14	6 32 53.609 _{124.567}	18 29 13.73 _{52.72}
15	4 55 23.247 _{123.885}	17 35 21.46 _{183.48}	15	6 34 58.176 _{124.548}	18 28 21.01 _{57.78}
16	4 57 27.132 _{123.929}	17 38 24.94 _{178.62}	16	6 37 02.724 _{124.526}	18 27 23.23 _{62.83}
17	4 59 31.061 _{123.973}	17 41 23.56 _{173.77}	17	6 39 07.250 _{124.503}	18 26 20.40 _{67.89}
18	5 01 35.034 _{124.015}	17 44 17.33 _{168.89}	18	6 41 11.753 _{124.478}	18 25 12.51 _{72.93}
19	5 03 39.049 _{124.056}	17 47 06.22 _{164.00}	19	6 43 16.231 _{124.453}	18 23 59.58 _{77.97}
20	5 05 43.105 _{124.096}	17 49 50.22 _{159.10}	20	6 45 20.684 _{124.425}	18 22 41.61 _{83.00}
21	5 07 47.201 _{124.135}	17 52 29.32 _{154.20}	21	6 47 25.109 _{124.397}	18 21 18.61 _{88.02}
22	5 09 51.336 _{124.173}	17 55 03.52 _{149.27}	22	6 49 29.506 _{124.367}	18 19 50.59 _{93.05}
23	5 11 55.509 _{124.209}	17 57 32.79 _{144.33}	23	6 51 33.873 _{124.335}	18 18 17.54 _{98.05}
24	5 13 59.718	+17 59 57.12	24	6 53 38.208	+18 16 39.49

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 25			June 27		
0	6 53 38.208 ^s	+18 16 39.49 ["]	0	8 32 08.341 ^s	+15 24 05.24 ["]
1	6 55 42.511 ^s	18 14 56.44 ["]	1	8 34 09.964 ^s	15 18 38.61 ["]
2	6 57 46.780 ^s	18 13 08.39 ["]	2	8 36 11.519 ^s	15 13 07.80 ["]
3	6 59 51.013 ^s	18 11 15.36 ["]	3	8 38 13.008 ^s	15 07 32.81 ["]
4	7 01 55.210 ^s	18 09 17.35 ["]	4	8 40 14.431 ^s	15 01 53.68 ["]
5	7 03 59.369 ^s	18 07 14.38 ["]	5	8 42 15.787 ^s	14 56 10.43 ["]
6	7 06 03.489 ^s	18 05 06.46 ["]	6	8 44 17.077 ^s	14 50 23.09 ["]
7	7 08 07.569 ^s	18 02 53.59 ["]	7	8 46 18.301 ^s	14 44 31.67 ["]
8	7 10 11.607 ^s	18 00 35.79 ["]	8	8 48 19.460 ^s	14 38 36.20 ["]
9	7 12 15.602 ^s	17 58 13.07 ["]	9	8 50 20.554 ^s	14 32 36.70 ["]
10	7 14 19.554 ^s	17 55 45.44 ["]	10	8 52 21.582 ^s	14 26 33.21 ["]
11	7 16 23.460 ^s	17 53 12.91 ["]	11	8 54 22.547 ^s	14 20 25.74 ["]
12	7 18 27.320 ^s	17 50 35.49 ["]	12	8 56 23.447 ^s	14 14 14.32 ["]
13	7 20 31.133 ^s	17 47 53.20 ["]	13	8 58 24.285 ^s	14 07 58.97 ["]
14	7 22 34.898 ^s	17 45 06.05 ["]	14	9 00 25.059 ^s	14 01 39.72 ["]
15	7 24 38.613 ^s	17 42 14.06 ["]	15	9 02 25.771 ^s	13 55 16.60 ["]
16	7 26 42.278 ^s	17 39 17.23 ["]	16	9 04 26.421 ^s	13 48 49.63 ["]
17	7 28 45.892 ^s	17 36 15.58 ["]	17	9 06 27.011 ^s	13 42 18.84 ["]
18	7 30 49.453 ^s	17 33 09.12 ["]	18	9 08 27.540 ^s	13 35 44.25 ["]
19	7 32 52.961 ^s	17 29 57.88 ["]	19	9 10 28.009 ^s	13 29 05.89 ["]
20	7 34 56.415 ^s	17 26 41.86 ["]	20	9 12 28.420 ^s	13 22 23.78 ["]
21	7 36 59.813 ^s	17 23 21.08 ["]	21	9 14 28.773 ^s	13 15 37.96 ["]
22	7 39 03.156 ^s	17 19 55.56 ["]	22	9 16 29.068 ^s	13 08 48.44 ["]
23	7 41 06.441 ^s	+17 16 25.31 ["]	23	9 18 29.307 ^s	+13 01 55.26 ["]
		-214.96			-416.82
June 26			June 28		
0	7 43 09.669 ^s	+17 12 50.35 ["]	0	9 20 29.490 ^s	+12 54 58.44 ["]
1	7 45 12.839 ^s	17 09 10.69 ["]	1	9 22 29.620 ^s	12 47 58.00 ["]
2	7 47 15.950 ^s	17 05 26.36 ["]	2	9 24 29.695 ^s	12 40 53.98 ["]
3	7 49 19.000 ^s	17 01 37.36 ["]	3	9 26 29.718 ^s	12 33 46.41 ["]
4	7 51 21.991 ^s	16 57 43.72 ["]	4	9 28 29.690 ^s	12 26 35.30 ["]
5	7 53 24.920 ^s	16 53 45.46 ["]	5	9 30 29.611 ^s	12 19 20.69 ["]
6	7 55 27.787 ^s	16 49 42.59 ["]	6	9 32 29.483 ^s	12 12 02.61 ["]
7	7 57 30.592 ^s	16 45 35.12 ["]	7	9 34 29.307 ^s	12 04 41.08 ["]
8	7 59 33.334 ^s	16 41 23.09 ["]	8	9 36 29.084 ^s	11 57 16.13 ["]
9	8 01 36.013 ^s	16 37 06.51 ["]	9	9 38 28.816 ^s	11 49 47.79 ["]
10	8 03 38.628 ^s	16 32 45.39 ["]	10	9 40 28.503 ^s	11 42 16.09 ["]
11	8 05 41.178 ^s	16 28 19.76 ["]	11	9 42 28.147 ^s	11 34 41.05 ["]
12	8 07 43.664 ^s	16 23 49.64 ["]	12	9 44 27.749 ^s	11 27 02.70 ["]
13	8 09 46.085 ^s	16 19 15.05 ["]	13	9 46 27.311 ^s	11 19 21.08 ["]
14	8 11 48.440 ^s	16 14 36.00 ["]	14	9 48 26.834 ^s	11 11 36.21 ["]
15	8 13 50.730 ^s	16 09 52.52 ["]	15	9 50 26.320 ^s	11 03 48.12 ["]
16	8 15 52.953 ^s	16 05 04.63 ["]	16	9 52 25.769 ^s	10 55 56.83 ["]
17	8 17 55.110 ^s	16 00 12.34 ["]	17	9 54 25.184 ^s	10 48 02.39 ["]
18	8 19 57.201 ^s	15 55 15.69 ["]	18	9 56 24.566 ^s	10 40 04.81 ["]
19	8 21 59.225 ^s	15 50 14.69 ["]	19	9 58 23.917 ^s	10 32 04.12 ["]
20	8 24 01.182 ^s	15 45 09.36 ["]	20	10 00 23.238 ^s	10 24 00.37 ["]
21	8 26 03.072 ^s	15 39 59.73 ["]	21	10 02 22.530 ^s	10 15 53.56 ["]
22	8 28 04.895 ^s	15 34 45.82 ["]	22	10 04 21.797 ^s	10 07 43.74 ["]
23	8 30 06.652 ^s	15 29 27.65 ["]	23	10 06 21.038 ^s	9 59 30.94 ["]
24	8 32 08.341 ^s	+15 24 05.24 ["]	24	10 08 20.256 ^s	+9 51 15.18 ["]
		-322.41			-495.76

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 29			July 1		
h	h m s	° ' " 18	h	h m s	° ' " 18
0	10 08 20.256	119.198 + 9 51 15.18	0	11 43 57.268	120.829 + 2 27 02.49
1	10 10 19.454	119.177 9 42 56.49	1	11 45 58.097	120.928 2 17 01.48
2	10 12 18.631	119.161 9 34 34.91	2	11 47 59.025	121.032 2 06 59.21
3	10 14 17.792	119.144 9 26 10.46	3	11 50 00.057	121.136 1 56 55.71
4	10 16 16.936	119.131 9 17 43.18	4	11 52 01.193	121.245 1 46 51.04
5	10 18 16.067	119.118 9 09 13.09	5	11 54 02.438	121.357 1 36 45.21
6	10 20 15.185	119.109 9 00 40.23	6	11 56 03.795	121.471 1 26 38.28
7	10 22 14.294	119.101 8 52 04.62	7	11 58 05.266	121.589 1 16 30.29
8	10 24 13.395	119.095 8 43 26.31	8	12 00 06.855	121.710 1 06 21.28
9	10 26 12.490	119.091 8 34 45.31	9	12 02 08.565	121.834 0 56 11.28
10	10 28 11.581	119.090 8 26 01.66	10	12 04 10.399	121.961 0 46 00.34
11	10 30 10.671	119.089 8 17 15.39	11	12 06 12.360	122.091 0 35 48.51
12	10 32 09.760	119.093 8 08 26.53	12	12 08 14.451	122.225 0 25 35.81
13	10 34 08.853	119.097 7 59 35.12	13	12 10 16.676	122.361 0 15 22.31
14	10 36 07.950	119.103 7 50 41.19	14	12 12 19.037	122.500 + 0 05 08.03
15	10 38 07.053	119.113 7 41 44.76	15	12 14 21.537	122.644 - 0 05 06.98
16	10 40 06.166	119.124 7 32 45.87	16	12 16 24.181	122.790 0 15 22.67
17	10 42 05.290	119.138 7 23 44.56	17	12 18 26.971	122.938 0 25 39.00
18	10 44 04.428	119.154 7 14 40.85	18	12 20 29.909	123.092 0 35 55.93
19	10 46 03.582	119.172 7 05 34.77	19	12 22 33.001	123.247 0 46 13.41
20	10 48 02.754	119.193 6 56 26.36	20	12 24 36.248	123.406 0 56 31.39
21	10 50 01.947	119.215 6 47 15.66	21	12 26 39.654	123.567 1 06 49.84
22	10 52 01.162	119.241 6 38 02.69	22	12 28 43.221	123.734 1 17 08.70
23	10 54 00.403	119.269 + 6 28 47.49	23	12 30 46.955	123.901 - 1 27 27.93
		-557.40			-619.55
June 30			July 2		
h	h m s	° ' " 18	h	h m s	° ' " 18
0	10 55 59.672	119.300 + 6 19 30.09	0	12 32 50.856	124.074 - 1 37 47.48
1	10 57 58.972	119.332 6 10 10.52	1	12 34 54.930	124.248 1 48 07.31
2	10 59 58.304	119.367 6 00 48.82	2	12 36 59.178	124.427 1 58 27.37
3	11 01 57.671	119.406 5 51 25.02	3	12 39 03.605	124.608 2 08 47.60
4	11 03 57.077	119.446 5 41 59.16	4	12 41 08.213	124.793 2 19 07.96
5	11 05 56.523	119.489 5 32 31.27	5	12 43 13.006	124.981 2 29 28.41
6	11 07 56.012	119.534 5 23 01.38	6	12 45 17.987	125.172 2 39 48.89
7	11 09 55.546	119.583 5 13 29.54	7	12 47 23.159	125.367 2 50 09.36
8	11 11 55.129	119.634 5 03 55.76	8	12 49 28.526	125.564 3 00 29.75
9	11 13 54.763	119.688 4 54 20.09	9	12 51 34.090	125.765 3 10 50.03
10	11 15 54.451	119.744 4 44 42.57	10	12 53 39.855	125.970 3 21 10.14
11	11 17 54.195	119.803 4 35 03.23	11	12 55 45.825	126.176 3 31 30.03
12	11 19 53.998	119.865 4 25 22.10	12	12 57 52.001	126.388 3 41 49.65
13	11 21 53.863	119.930 4 15 39.22	13	12 59 58.389	126.601 3 52 08.94
14	11 23 53.793	119.997 4 05 54.62	14	13 02 04.990	126.817 4 02 27.86
15	11 25 53.790	120.067 3 56 08.35	15	13 04 11.807	127.039 4 12 46.34
16	11 27 53.857	120.140 3 46 20.44	16	13 06 18.846	127.261 4 23 04.34
17	11 29 53.997	120.216 3 36 30.92	17	13 08 26.107	127.488 4 33 21.80
18	11 31 54.213	120.295 3 26 39.83	18	13 10 33.595	127.718 4 43 38.66
19	11 33 54.508	120.377 3 16 47.21	19	13 12 41.313	127.950 4 53 54.87
20	11 35 54.885	120.462 3 06 53.10	20	13 14 49.263	128.186 5 04 10.38
21	11 37 55.347	120.548 2 56 57.54	21	13 16 57.449	128.425 5 14 25.12
22	11 39 55.895	120.640 2 47 00.55	22	13 19 05.874	128.668 5 24 39.04
23	11 41 56.535	120.733 2 37 02.19	23	13 21 14.542	128.912 5 34 52.08
24	11 43 57.268	+ 2 27 02.49	24	13 23 23.454	- 5 45 04.19
		-599.70			-612.11

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
July 3									July 5										
h	h	m	s	°	'	"	°	'	"	h	h	m	s	°	'	"	°	'	"
0	13	23	23.454	129.161	5	45 04.19	611.11	15	12 11.341	143.897	13	15 11.71	484.12						
1	13	25	32.615	129.412	5	55 15.30	610.06	15	14 35.238	144.238	13	23 15.83	479.64						
2	13	27	42.027	129.666	6	05 25.36	608.94	15	16 59.476	144.579	13	31 15.47	475.08						
3	13	29	51.693	129.923	6	15 34.30	607.77	15	19 24.055	144.920	13	39 10.55	470.44						
4	13	32	01.616	130.184	6	25 42.07	606.53	15	21 48.975	145.259	13	47 00.99	465.71						
5	13	34	11.800	130.447	6	35 48.60	605.24	15	24 14.234	145.600	13	54 46.70	460.92						
6	13	36	22.247	130.712	6	45 53.84	603.87	15	26 39.834	145.939	14	02 27.62	456.03						
7	13	38	32.959	130.982	6	55 57.71	602.46	15	29 05.773	146.278	14	10 03.65	451.07						
8	13	40	43.941	131.253	7	06 00.17	600.97	15	31 32.051	146.616	14	17 34.72	446.03						
9	13	42	55.194	131.528	7	16 01.14	599.43	15	33 58.667	146.954	14	25 00.75	440.91						
10	13	45	06.722	131.805	7	26 00.57	597.81	15	36 25.621	147.289	14	32 21.66	435.70						
11	13	47	18.527	132.086	7	35 58.38	596.14	15	38 52.910	147.625	14	39 37.36	430.42						
12	13	49	30.613	132.368	7	45 54.52	594.40	15	41 20.535	147.959	14	46 47.78	425.06						
13	13	51	42.981	132.653	7	55 48.92	592.59	15	43 48.494	148.291	14	53 52.84	419.62						
14	13	53	55.634	132.942	8	05 41.51	590.72	15	46 16.785	148.623	15	00 52.46	414.10						
15	13	56	08.576	133.232	8	15 32.23	588.77	15	48 45.408	148.952	15	07 46.56	408.49						
16	13	58	21.808	133.526	8	25 21.00	586.77	15	51 14.360	149.280	15	14 35.05	402.82						
17	14	00	35.334	133.821	8	35 07.77	584.69	17	53 43.640	149.606	15	21 17.87	397.06						
18	14	02	49.155	134.119	8	44 52.46	582.56	17	56 13.246	149.930	15	27 54.93	391.23						
19	14	05	03.274	134.420	8	54 35.02	580.33	18	58 43.176	150.252	15	34 26.16	385.32						
20	14	07	17.694	134.723	9	04 15.35	578.06	20	01 13.428	150.571	15	40 51.48	379.32						
21	14	09	32.417	135.028	9	13 53.41	575.70	21	03 43.999	150.888	15	47 10.80	373.26						
22	14	11	47.445	135.335	9	23 29.11	573.28	22	06 14.887	151.203	15	53 24.06	367.11						
23	14	14	02.780	135.645	9	33 02.39	570.79	23	08 46.090	151.515	15	59 31.17	360.90						
July 4									July 6										
0	14	16	18.425	135.957	9	42 33.18	568.23	0	16 11 17.605	151.824	16	05 32.07	354.61						
1	14	18	34.382	136.271	9	52 01.41	565.58	1	16 13 49.429	152.130	16	11 26.68	348.23						
2	14	20	50.653	136.587	10	01 26.99	562.88	2	16 16 21.559	152.433	16	17 14.91	341.80						
3	14	23	07.240	136.904	10	10 49.87	560.10	3	16 18 53.992	152.733	16	22 56.71	335.28						
4	14	25	24.144	137.224	10	20 09.97	557.24	4	16 21 26.725	153.029	16	28 31.99	328.69						
5	14	27	41.368	137.546	10	29 27.21	554.31	5	16 23 59.754	153.323	16	34 00.68	322.04						
6	14	29	58.914	137.869	10	38 41.52	551.31	6	16 26 33.077	153.612	16	39 22.72	315.30						
7	14	32	16.783	138.194	10	47 52.83	548.23	7	16 29 06.689	153.897	16	44 38.02	308.51						
8	14	34	34.977	138.521	10	57 01.06	545.08	8	16 31 40.586	154.179	16	49 46.53	301.63						
9	14	36	53.498	138.849	11	06 06.14	541.85	9	16 34 14.765	154.457	16	54 48.16	294.70						
10	14	39	12.347	139.178	11	15 07.99	538.54	10	16 36 49.222	154.730	16	59 42.86	287.70						
11	14	41	31.525	139.509	11	24 06.53	535.17	11	16 39 23.952	154.999	17	04 30.56	280.62						
12	14	43	51.034	139.841	11	33 01.70	531.70	12	16 41 58.951	155.264	17	09 11.18	273.49						
13	14	46	10.875	140.175	11	41 53.40	528.17	13	16 44 34.215	155.524	17	13 44.67	266.30						
14	14	48	31.050	140.509	11	50 41.57	524.56	14	16 47 09.739	155.779	17	18 10.97	259.03						
15	14	50	51.559	140.845	11	59 26.13	520.87	15	16 49 45.518	156.030	17	22 30.00	251.70						
16	14	53	12.404	141.182	12	08 07.00	517.10	16	16 52 21.548	156.275	17	26 41.70	244.32						
17	14	55	33.586	141.519	12	16 44.10	513.26	17	16 54 57.823	156.515	17	30 46.02	236.88						
18	14	57	55.105	141.857	12	25 17.36	509.33	18	16 57 34.338	156.751	17	34 42.90	229.82						
19	15	00	16.962	142.196	12	33 46.69	505.33	19	17 00 11.089	156.981	17	38 32.28	221.82						
20	15	02	39.158	142.536	12	42 12.02	501.24	20	17 02 48.070	157.205	17	42 14.10	214.20						
21	15	05	01.694	142.875	12	50 33.26	497.09	21	17 05 25.275	157.423	17	45 48.30	206.54						
22	15	07	24.569	143.216	12	58 50.35	492.84	22	17 08 02.698	157.637	17	49 14.84	198.82						
23	15	09	47.785	143.556	13	07 03.19	488.52	23	17 10 40.335	157.844	17	52 33.66	191.05						
24	15	12	11.341	143.897	13	15 11.71		24	17 13 18.179		17	55 44.71							

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
July 7							July 9						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	17	13	18.179	158.045	-17	55 44.71	0	19	21	23.951	159.398	-17	46 56.07
1	17	15	56.224	158.240	17	58 47.93	1	19	24	03.349	159.248	17	43 21.45
2	17	18	34.464	158.430	18	01 43.29	2	19	26	42.597	159.092	17	39 38.88
3	17	21	12.894	158.612	18	04 30.74	3	19	29	21.689	158.929	17	35 48.40
4	17	23	51.506	158.789	18	07 10.22	4	19	32	00.618	158.759	17	31 50.08
5	17	26	30.295	158.958	18	09 41.70	5	19	34	39.377	158.584	17	27 43.95
6	17	29	09.253	159.122	18	12 05.14	6	19	37	17.961	158.402	17	23 30.07
7	17	31	48.375	159.279	18	14 20.49	7	19	39	56.363	158.214	17	19 08.49
8	17	34	27.654	159.428	18	16 27.73	8	19	42	34.577	158.020	17	14 39.26
9	17	37	07.082	159.572	18	18 26.80	9	19	45	12.597	157.821	17	10 02.45
10	17	39	46.654	159.708	18	20 17.68	10	19	47	50.418	157.615	17	05 18.11
11	17	42	26.362	159.837	18	22 00.33	11	19	50	28.033	157.405	17	00 26.30
12	17	45	06.199	159.960	18	23 34.73	12	19	53	05.438	157.188	16	55 27.07
13	17	47	46.159	160.075	18	25 00.84	13	19	55	42.626	156.967	16	50 20.50
14	17	50	26.234	160.182	18	26 18.64	14	19	58	19.593	156.739	16	45 06.65
15	17	53	06.416	160.283	18	27 28.10	15	20	00	56.332	156.508	16	39 45.57
16	17	55	46.699	160.376	18	28 29.20	16	20	03	32.840	156.271	16	34 17.35
17	17	58	27.075	160.463	18	29 21.91	17	20	06	09.111	156.029	16	28 42.03
18	18	01	07.538	160.541	18	30 06.23	18	20	08	45.140	155.782	16	22 59.70
19	18	03	48.079	160.612	18	30 42.12	19	20	11	20.922	155.532	16	17 10.43
20	18	06	28.691	160.675	18	31 09.58	20	20	13	56.454	155.276	16	11 14.27
21	18	09	09.366	160.732	18	31 28.60	21	20	16	31.730	155.016	16	05 11.32
22	18	11	50.098	160.779	18	31 39.15	22	20	19	06.746	154.753	15	59 01.63
23	18	14	30.877	160.821	-18	31 41.23	23	20	21	41.499	154.484	-15	52 45.29
						6.39							+382.92
July 8							July 10						
0	18	17	11.698	160.854	-18	31 34.84	0	20	24	15.983	154.213	-15	46 22.37
1	18	19	52.552	160.880	18	31 19.97	1	20	26	50.196	153.937	15	39 52.95
2	18	22	33.432	160.898	18	30 56.61	2	20	29	24.133	153.657	15	33 17.10
3	18	25	14.330	160.908	18	30 24.77	3	20	31	57.790	153.375	15	26 34.90
4	18	27	55.238	160.911	18	29 44.44	4	20	34	31.165	153.089	15	19 46.43
5	18	30	36.149	160.906	18	28 55.63	5	20	37	04.254	152.799	15	12 51.76
6	18	33	17.055	160.893	18	27 58.35	6	20	39	37.053	152.507	15	05 51.00
7	18	35	57.948	160.873	18	26 52.60	7	20	42	09.560	152.212	14	58 44.20
8	18	38	38.821	160.846	18	25 38.39	8	20	44	41.772	151.913	14	51 31.45
9	18	41	19.667	160.810	18	24 15.73	9	20	47	13.685	151.613	14	44 12.84
10	18	44	00.477	160.767	18	22 44.63	10	20	49	45.298	151.309	14	36 48.45
11	18	46	41.244	160.717	18	21 05.12	11	20	52	16.607	151.003	14	29 18.36
12	18	49	21.961	160.658	18	19 17.21	12	20	54	47.610	150.695	14	21 42.66
13	18	52	02.619	160.594	18	17 20.91	13	20	57	18.305	150.385	14	14 01.43
14	18	54	43.213	160.521	18	15 16.25	14	20	59	48.690	150.073	14	06 14.76
15	18	57	23.734	160.440	18	13 03.26	15	21	02	18.763	149.759	13	58 22.73
16	19	00	04.174	160.353	18	10 41.96	16	21	04	48.522	149.442	13	50 25.42
17	19	02	44.527	160.259	18	08 12.37	17	21	07	17.964	149.126	13	42 22.93
18	19	05	24.786	160.156	18	05 34.53	18	21	09	47.090	148.806	13	34 15.34
19	19	08	04.942	160.048	18	02 48.47	19	21	12	15.896	148.486	13	26 02.73
20	19	10	44.990	159.931	17	59 54.22	20	21	14	44.382	148.164	13	17 45.20
21	19	13	24.921	159.809	17	56 51.81	21	21	17	12.546	147.842	13	09 22.83
22	19	16	04.730	159.679	17	53 41.29	22	21	19	40.388	147.518	13	00 55.70
23	19	18	44.409	159.542	17	50 22.70	23	21	22	07.906	147.194	12	52 23.91
24	19	21	23.951		-17	46 56.07	24	21	24	35.100		-12	43 47.55
						+206.63							+516.36

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 11			July 13		
h	h m s	° ' "	h	h m s	° ' "
0	21 24 35.100	146.868	0	23 16 06.939	132.229
1	21 27 01.968	146.542	1	23 18 19.168	131.973
2	21 29 28.510	146.216	2	23 20 31.141	131.721
3	21 31 54.726	145.889	3	23 22 42.862	131.470
4	21 34 20.615	145.562	4	23 24 54.332	131.223
5	21 36 46.177	145.234	5	23 27 05.555	130.978
6	21 39 11.411	144.907	6	23 29 16.533	130.737
7	21 41 36.318	144.579	7	23 31 27.270	130.499
8	21 44 00.897	144.252	8	23 33 37.769	130.262
9	21 46 25.149	143.925	9	23 35 48.031	130.030
10	21 48 49.074	143.599	10	23 37 58.061	129.800
11	21 51 12.673	143.272	11	23 40 07.861	129.574
12	21 53 35.945	142.946	12	23 42 17.435	129.349
13	21 55 58.891	142.621	13	23 44 26.784	129.129
14	21 58 21.512	142.297	14	23 46 35.913	128.911
15	22 00 43.809	141.973	15	23 48 44.824	128.696
16	22 03 05.782	141.651	16	23 50 53.520	128.485
17	22 05 27.433	141.328	17	23 53 02.005	128.276
18	22 07 48.761	141.009	18	23 55 10.281	128.070
19	22 10 09.770	140.688	19	23 57 18.351	127.869
20	22 12 30.458	140.371	20	23 59 26.220	127.668
21	22 14 50.829	140.053	21	00 01 33.888	127.473
22	22 17 10.882	139.738	22	00 03 41.361	127.279
23	22 19 30.620	139.424	23	00 05 48.640	127.089
July 12			July 14		
h	h m s	° ' "	h	h m s	° ' "
0	22 21 50.044	139.111	0	00 07 55.729	126.902
1	22 24 09.155	138.801	1	00 10 02.631	126.718
2	22 26 27.956	138.491	2	00 12 09.349	126.537
3	22 28 46.447	138.184	3	00 14 15.886	126.360
4	22 31 04.631	137.878	4	00 16 22.246	126.185
5	22 33 22.509	137.574	5	00 18 28.431	126.014
6	22 35 40.083	137.273	6	00 20 34.445	125.845
7	22 37 57.356	136.972	7	00 22 40.290	125.680
8	22 40 14.328	136.675	8	00 24 45.970	125.517
9	22 42 31.003	136.379	9	00 26 51.487	125.358
10	22 44 47.382	136.086	10	00 28 56.845	125.203
11	22 47 03.468	135.794	11	00 31 02.048	125.049
12	22 49 19.262	135.505	12	00 33 07.097	124.899
13	22 51 34.767	135.218	13	00 35 11.996	124.753
14	22 53 49.985	134.934	14	00 37 16.749	124.608
15	22 56 04.919	134.652	15	00 39 21.357	124.468
16	22 58 19.571	134.373	16	00 41 25.825	124.330
17	23 00 33.944	134.095	17	00 43 30.155	124.196
18	23 02 48.039	133.821	18	00 45 34.351	124.063
19	23 05 01.860	133.549	19	00 47 38.414	123.935
20	23 07 15.409	133.280	20	00 49 42.349	123.809
21	23 09 28.689	133.013	21	00 51 46.158	123.686
22	23 11 41.702	132.749	22	00 53 49.844	123.567
23	23 13 54.451	132.488	23	00 55 53.411	123.449
24	23 16 06.939		24	00 57 56.860	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 15			July 17		
h	h m s	° ' "	h	h m s	° ' "
0	0 57 56.860	123.336	0	2 35 18.249	120.935
1	1 00 00.196	123.225	1	2 37 19.184	120.939
2	1 02 03.421	123.116	2	2 39 20.123	120.945
3	1 04 06.537	123.011	3	2 41 21.068	120.953
4	1 06 09.548	122.909	4	2 43 22.021	120.962
5	1 08 12.457	122.810	5	2 45 22.983	120.972
6	1 10 15.267	122.713	6	2 47 23.955	120.985
7	1 12 17.980	122.619	7	2 49 24.940	121.000
8	1 14 20.599	122.528	8	2 51 25.940	121.014
9	1 16 23.127	122.439	9	2 53 26.954	121.032
10	1 18 25.566	122.355	10	2 55 27.986	121.050
11	1 20 27.921	122.271	11	2 57 29.036	121.070
12	1 22 30.192	122.192	12	2 59 30.106	121.092
13	1 24 32.384	122.114	13	3 01 31.198	121.114
14	1 26 34.498	122.040	14	3 03 32.312	121.139
15	1 28 36.538	121.967	15	3 05 33.451	121.164
16	1 30 38.505	121.899	16	3 07 34.615	121.191
17	1 32 40.404	121.832	17	3 09 35.806	121.219
18	1 34 42.236	121.768	18	3 11 37.025	121.248
19	1 36 44.004	121.706	19	3 13 38.273	121.278
20	1 38 45.710	121.647	20	3 15 39.551	121.310
21	1 40 47.357	121.591	21	3 17 40.861	121.343
22	1 42 48.948	121.537	22	3 19 42.204	121.376
23	1 44 50.485	121.486	23	3 21 43.580	121.411
July 16			July 18		
0	1 46 51.971	121.437	0	3 23 44.991	121.447
1	1 48 53.408	121.391	1	3 25 46.438	121.483
2	1 50 54.799	121.346	2	3 27 47.921	121.521
3	1 52 56.145	121.305	3	3 29 49.442	121.560
4	1 54 57.450	121.265	4	3 31 51.002	121.599
5	1 56 58.715	121.229	5	3 33 52.601	121.640
6	1 58 59.944	121.194	6	3 35 54.241	121.680
7	2 01 01.138	121.161	7	3 37 55.921	121.722
8	2 03 02.299	121.132	8	3 39 57.643	121.765
9	2 05 03.431	121.103	9	3 41 59.408	121.808
10	2 07 04.534	121.078	10	3 44 01.216	121.852
11	2 09 05.612	121.055	11	3 46 03.068	121.896
12	2 11 06.667	121.033	12	3 48 04.964	121.941
13	2 13 07.700	121.015	13	3 50 06.905	121.987
14	2 15 08.715	120.997	14	3 52 08.892	122.033
15	2 17 09.712	120.982	15	3 54 10.925	122.080
16	2 19 10.694	120.969	16	3 56 13.005	122.127
17	2 21 11.663	120.958	17	3 58 15.132	122.174
18	2 23 12.621	120.949	18	4 00 17.306	122.222
19	2 25 13.570	120.942	19	4 02 19.528	122.270
20	2 27 14.512	120.937	20	4 04 21.798	122.318
21	2 29 15.449	120.934	21	4 06 24.116	122.367
22	2 31 16.383	120.933	22	4 08 26.483	122.416
23	2 33 17.316	120.933	23	4 10 28.899	122.465
24	2 35 18.249	120.933	24	4 12 31.364	122.514

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
July 19							July 21						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	4	12	31.364	122.514	+16	04 33.14	0	5	51	22.839	124.429	+18	24 43.86
1	4	14	33.878	122.564	16 09 19.08	+285.94	1	5	53	27.268	124.449	18 25 38.88	+55.02
2	4	16	36.442	122.613	16 14 00.54	281.46	2	5	55	31.717	124.466	18 26 28.84	49.96
3	4	18	39.055	122.662	16 18 37.51	276.97	3	5	57	36.183	124.484	18 27 13.76	44.92
4	4	20	41.717	122.712	16 23 09.97	272.46	4	5	59	40.667	124.499	18 27 53.61	39.85
5	4	22	44.429	122.762	16 27 37.90	267.93	5	6	01	45.166	124.514	18 28 28.41	34.80
6	4	24	47.191	122.811	16 32 01.28	263.38	6	6	03	49.680	124.527	18 28 58.14	29.73
7	4	26	50.002	122.860	16 36 20.09	258.81	7	6	05	54.207	124.538	18 29 22.80	24.66
8	4	28	52.862	122.909	16 40 34.33	254.24	8	6	07	58.745	124.550	18 29 42.39	19.59
9	4	30	55.771	122.959	16 44 43.96	249.63	9	6	10	03.295	124.559	18 29 56.91	14.52
10	4	32	58.730	123.007	16 48 48.99	245.03	10	6	12	07.854	124.567	18 30 06.36	9.45
11	4	35	01.737	123.056	16 52 49.38	240.39	11	6	14	12.421	124.573	18 30 10.73	+4.37
12	4	37	04.793	123.105	16 56 45.13	235.75	12	6	16	16.994	124.580	18 30 10.03	0.70
13	4	39	07.898	123.152	17 00 36.21	231.08	13	6	18	21.574	124.583	18 30 04.25	5.78
14	4	41	11.050	123.201	17 04 22.62	226.41	14	6	20	26.157	124.586	18 29 53.39	10.86
15	4	43	14.251	123.247	17 08 04.33	221.71	15	6	22	30.743	124.588	18 29 37.46	15.93
16	4	45	17.498	123.295	17 11 41.34	217.01	16	6	24	35.331	124.588	18 29 16.45	21.01
17	4	47	20.793	123.342	17 15 13.62	212.28	17	6	26	39.919	124.587	18 28 50.36	26.09
18	4	49	24.135	123.388	17 18 41.16	207.54	18	6	28	44.506	124.585	18 28 19.20	31.16
19	4	51	27.523	123.433	17 22 03.96	202.80	19	6	30	49.091	124.581	18 27 42.97	36.23
20	4	53	30.956	123.479	17 25 21.99	198.03	20	6	32	53.672	124.581	18 27 01.66	41.31
21	4	55	34.435	123.523	17 28 35.24	193.25	21	6	34	58.247	124.575	18 26 15.29	46.37
22	4	57	37.958	123.567	17 31 43.69	188.45	22	6	37	02.817	124.570	18 25 23.85	51.44
23	4	59	41.525	123.611	+17 34 47.34	183.65	23	6	39	07.378	124.561	+18 24 27.35	56.50
						+178.83					124.552		61.56
July 20							July 22						
0	5	01	45.136	123.654	+17 37 46.17	+174.00	0	6	41	11.930	124.542	+18 23 25.79	-66.61
1	5	03	48.790	123.696	17 40 40.17	169.16	1	6	43	16.472	124.530	18 22 19.18	71.66
2	5	05	52.486	123.738	17 43 29.33	164.30	2	6	45	21.002	124.517	18 21 07.52	76.71
3	5	07	56.224	123.779	17 46 13.63	159.43	3	6	47	25.519	124.503	18 19 50.81	81.76
4	5	10	00.003	123.818	17 48 53.06	154.55	4	6	49	30.022	124.487	18 18 29.05	86.78
5	5	12	03.821	123.858	17 51 27.61	149.66	5	6	51	34.509	124.470	18 17 02.27	91.82
6	5	14	07.679	123.897	17 53 57.27	144.76	6	6	53	38.979	124.451	18 15 30.45	96.83
7	5	16	11.576	123.934	17 56 22.03	139.85	7	6	55	43.430	124.432	18 13 53.62	101.86
8	5	18	15.510	123.972	17 58 41.88	134.92	8	6	57	47.862	124.411	18 12 11.76	106.86
9	5	20	19.482	124.007	18 00 56.80	129.99	9	6	59	52.273	124.388	18 10 24.90	111.87
10	5	22	23.489	124.042	18 03 06.79	125.05	10	7	01	56.661	124.365	18 08 33.03	116.86
11	5	24	27.531	124.077	18 05 11.84	120.10	11	7	04	01.026	124.340	18 06 36.17	121.84
12	5	26	31.608	124.110	18 07 11.94	115.13	12	7	06	05.366	124.314	18 04 34.33	126.83
13	5	28	35.718	124.143	18 09 07.07	110.17	13	7	08	09.680	124.287	18 02 27.50	131.79
14	5	30	39.861	124.174	18 10 57.24	105.18	14	7	10	13.967	124.258	18 00 15.71	136.75
15	5	32	44.035	124.204	18 12 42.42	100.21	15	7	12	18.225	124.229	17 57 58.96	141.70
16	5	34	48.239	124.233	18 14 22.63	95.20	16	7	14	22.454	124.197	17 55 37.26	146.63
17	5	36	52.472	124.262	18 15 57.83	90.21	17	7	16	26.651	124.166	17 53 10.63	151.57
18	5	38	56.734	124.289	18 17 28.04	85.20	18	7	18	30.817	124.132	17 50 39.06	156.48
19	5	41	01.023	124.315	18 18 53.24	80.18	19	7	20	34.949	124.097	17 48 02.58	161.39
20	5	43	05.338	124.341	18 20 13.42	75.16	20	7	22	39.046	124.062	17 45 21.19	166.29
21	5	45	09.679	124.364	18 21 28.58	70.13	21	7	24	43.108	124.025	17 42 34.90	171.16
22	5	47	14.043	124.387	18 22 38.71	65.10	22	7	26	47.133	123.987	17 39 43.74	176.04
23	5	49	18.430	124.409	18 23 43.81	60.05	23	7	28	51.120	123.949	17 36 47.70	-180.89
24	5	51	22.839		+18 24 43.86		24	7	30	55.069		+17 33 46.81	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
July 23							July 25						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	7 30	55.069	^s _{123.908}	+17 33	46.81	-185.74	0	9 09	02.980	^s _{121.198}	+13 39	29.79	-396.12
1	7 32	58.977	_{123.867}	17 30	41.07	190.57	1	9 11	04.178	_{121.138}	13 32	53.67	399.92
2	7 35	02.844	_{123.824}	17 27	30.50	195.38	2	9 13	05.316	_{121.077}	13 26	13.75	403.69
3	7 37	06.668	_{123.782}	17 24	15.12	200.19	3	9 15	06.393	_{121.017}	13 19	30.06	407.43
4	7 39	10.450	_{123.737}	17 20	54.93	204.97	4	9 17	07.410	_{120.958}	13 12	42.63	411.15
5	7 41	14.187	_{123.692}	17 17	29.96	209.75	5	9 19	08.368	_{120.899}	13 05	51.48	414.83
6	7 43	17.879	_{123.646}	17 14	00.21	214.50	6	9 21	09.267	_{120.840}	12 58	56.65	418.49
7	7 45	21.525	_{123.599}	17 10	25.71	219.25	7	9 23	10.107	_{120.783}	12 51	58.16	422.11
8	7 47	25.124	_{123.551}	17 06	46.46	223.97	8	9 25	10.890	_{120.724}	12 44	56.05	425.71
9	7 49	28.675	_{123.502}	17 03	02.49	228.68	9	9 27	11.614	_{120.668}	12 37	50.34	429.29
10	7 51	32.177	_{123.452}	16 59	13.81	233.37	10	9 29	12.282	_{120.612}	12 30	41.05	432.81
11	7 53	35.629	_{123.401}	16 55	20.44	238.05	11	9 31	12.894	_{120.557}	12 23	28.24	436.33
12	7 55	39.030	_{123.350}	16 51	22.39	242.70	12	9 33	13.451	_{120.501}	12 16	11.91	439.81
13	7 57	42.380	_{123.298}	16 47	19.69	247.35	13	9 35	13.952	_{120.448}	12 08	52.10	443.25
14	7 59	45.678	_{123.245}	16 43	12.34	251.97	14	9 37	14.400	_{120.395}	12 01	28.85	446.67
15	8 01	48.923	_{123.191}	16 39	00.37	256.57	15	9 39	14.795	_{120.342}	11 54	02.18	450.06
16	8 03	52.114	_{123.137}	16 34	43.80	261.15	16	9 41	15.137	_{120.290}	11 46	32.12	453.41
17	8 05	55.251	_{123.082}	16 30	22.65	265.72	17	9 43	15.427	_{120.240}	11 38	58.71	456.74
18	8 07	58.333	_{123.026}	16 25	56.93	270.27	18	9 45	15.667	_{120.190}	11 31	21.97	460.03
19	8 10	01.359	_{122.969}	16 21	26.66	274.80	19	9 47	15.857	_{120.141}	11 23	41.94	463.29
20	8 12	04.328	_{122.913}	16 16	51.86	279.30	20	9 49	15.998	_{120.094}	11 15	58.65	466.52
21	8 14	07.241	_{122.855}	16 12	12.56	283.78	21	9 51	16.092	_{120.046}	11 08	12.13	469.72
22	8 16	10.096	_{122.797}	16 07	28.78	288.25	22	9 53	16.138	_{120.001}	11 00	22.41	472.89
23	8 18	12.893	_{122.738}	+16 02	40.53	-292.70	23	9 55	16.139	_{119.957}	+10 52	29.52	-476.02
July 24							July 26						
0	8 20	15.631	_{122.679}	+15 57	47.83	-297.11	0	9 57	16.096	_{119.912}	+10 44	33.50	-479.13
1	8 22	18.310	_{122.620}	15 52	50.72	301.52	1	9 59	16.008	_{119.871}	10 36	34.37	482.19
2	8 24	20.930	_{122.560}	15 47	49.20	305.90	2	10 01	15.879	_{119.829}	10 28	32.18	485.23
3	8 26	23.490	_{122.499}	15 42	43.30	310.25	3	10 03	15.708	_{119.789}	10 20	26.95	488.24
4	8 28	25.989	_{122.439}	15 37	33.05	314.59	4	10 05	15.497	_{119.751}	10 12	18.71	491.21
5	8 30	28.428	_{122.378}	15 32	18.46	318.90	5	10 07	15.248	_{119.713}	10 04	07.50	494.14
6	8 32	30.806	_{122.316}	15 26	59.56	323.19	6	10 09	14.961	_{119.677}	9 55	53.36	497.06
7	8 34	33.122	_{122.255}	15 21	36.37	327.45	7	10 11	14.638	_{119.642}	9 47	36.30	499.92
8	8 36	35.377	_{122.192}	15 16	08.92	331.69	8	10 13	14.280	_{119.609}	9 39	16.38	502.76
9	8 38	37.569	_{122.131}	15 10	37.23	335.91	9	10 15	13.889	_{119.576}	9 30	53.62	505.57
10	8 40	39.700	_{122.069}	15 05	01.32	340.11	10	10 17	13.465	_{119.547}	9 22	28.05	508.33
11	8 42	41.769	_{122.006}	14 59	21.21	344.27	11	10 19	13.012	_{119.517}	9 13	59.72	511.08
12	8 44	43.775	_{121.943}	14 53	36.94	348.42	12	10 21	12.529	_{119.489}	9 05	28.64	513.78
13	8 46	45.718	_{121.881}	14 47	48.52	352.53	13	10 23	12.018	_{119.464}	8 56	54.86	516.44
14	8 48	47.599	_{121.819}	14 41	55.99	356.63	14	10 25	11.482	_{119.439}	8 48	18.42	519.08
15	8 50	49.418	_{121.756}	14 35	59.36	360.70	15	10 27	10.921	_{119.416}	8 39	39.34	521.68
16	8 52	51.174	_{121.693}	14 29	58.66	364.74	16	10 29	10.337	_{119.395}	8 30	57.66	524.25
17	8 54	52.867	_{121.631}	14 23	53.92	368.75	17	10 31	09.732	_{119.375}	8 22	13.41	526.78
18	8 56	54.498	_{121.569}	14 17	45.17	372.75	18	10 33	09.107	_{119.357}	8 13	26.63	529.27
19	8 58	56.067	_{121.506}	14 11	32.42	376.71	19	10 35	08.464	_{119.341}	8 04	37.36	531.73
20	9 00	57.573	_{121.444}	14 05	15.71	380.64	20	10 37	07.805	_{119.327}	7 55	45.63	534.16
21	9 02	59.017	_{121.383}	13 58	55.07	384.55	21	10 39	07.132	_{119.313}	7 46	51.47	536.55
22	9 05	00.400	_{121.321}	13 52	30.52	388.44	22	10 41	06.445	_{119.303}	7 37	54.92	538.90
23	9 07	01.721	_{121.259}	13 46	02.08	-392.29	23	10 43	05.748	_{119.294}	7 28	56.02	-541.22
24	9 09	02.980		+13 39	29.79		24	10 45	05.042		+ 7 19	54.80	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 27			July 29		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	10 45 05.042	119.287	0	12 21 02.572	121.597
1	10 47 04.329	119.281	1	12 23 04.169	121.708
2	10 49 03.610	119.278	2	12 25 05.877	121.822
3	10 51 02.888	119.276	3	12 27 07.699	121.941
4	10 53 02.164	119.277	4	12 29 09.640	122.060
5	10 55 01.441	119.279	5	12 31 11.700	122.184
6	10 57 00.720	119.283	6	12 33 13.884	122.309
7	10 59 00.003	119.290	7	12 35 16.193	122.439
8	11 00 59.293	119.299	8	12 37 18.632	122.571
9	11 02 58.592	119.309	9	12 39 21.203	122.705
10	11 04 57.901	119.322	10	12 41 23.908	122.843
11	11 06 57.223	119.337	11	12 43 26.751	122.984
12	11 08 56.560	119.354	12	12 45 29.735	123.127
13	11 10 55.914	119.373	13	12 47 32.862	123.274
14	11 12 55.287	119.395	14	12 49 36.136	123.423
15	11 14 54.682	119.419	15	12 51 39.559	123.575
16	11 16 54.101	119.444	16	12 53 43.134	123.731
17	11 18 53.545	119.473	17	12 55 46.865	123.889
18	11 20 53.018	119.503	18	12 57 50.754	124.050
19	11 22 52.521	119.537	19	12 59 54.804	124.214
20	11 24 52.058	119.571	20	13 01 59.018	124.381
21	11 26 51.629	119.610	21	13 04 03.399	124.551
22	11 28 51.239	119.649	22	13 06 07.950	124.724
23	11 30 50.888	119.692	23	13 08 12.674	124.899
July 28			July 30		
0	11 32 50.580	119.737	0	13 10 17.573	125.079
1	11 34 50.317	119.784	1	13 12 22.652	125.260
2	11 36 50.101	119.835	2	13 14 27.912	125.445
3	11 38 49.936	119.886	3	13 16 33.357	125.632
4	11 40 49.822	119.942	4	13 18 38.989	125.822
5	11 42 49.764	119.999	5	13 20 44.811	126.016
6	11 44 49.763	120.059	6	13 22 50.827	126.212
7	11 46 49.822	120.121	7	13 24 57.039	126.411
8	11 48 49.943	120.187	8	13 27 03.450	126.612
9	11 50 50.130	120.255	9	13 29 10.062	126.818
10	11 52 50.385	120.325	10	13 31 16.880	127.025
11	11 54 50.710	120.398	11	13 33 23.905	127.235
12	11 56 51.108	120.474	12	13 35 31.140	127.449
13	11 58 51.582	120.552	13	13 37 38.589	127.664
14	12 00 52.134	120.633	14	13 39 46.253	127.884
15	12 02 52.767	120.718	15	13 41 54.137	128.104
16	12 04 53.485	120.804	16	13 44 02.241	128.329
17	12 06 54.289	120.893	17	13 46 10.570	128.557
18	12 08 55.182	120.985	18	13 48 19.127	128.785
19	12 10 56.167	121.080	19	13 50 27.912	129.018
20	12 12 57.247	121.178	20	13 52 36.930	129.253
21	12 14 58.425	121.278	21	13 54 46.183	129.491
22	12 16 59.703	121.382	22	13 56 55.674	129.731
23	12 19 01.085	121.487	23	13 59 05.405	129.973
24	12 21 02.572		24	14 01 15.378	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination											
July 31									August 2																
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"								
0	14	01	15	378	130°219	-	8	25	28	88	-	569.40	0	15	50	39	589	144°069	-15	02	44	29	-	394.67	
1	14	03	25	597	130°467		8	34	58	28		567.27	1	15	53	03	658	144°375		15	09	18	96		389.37
2	14	05	36	064	130°717		8	44	25	55		565.08	2	15	55	28	033	144°678		15	15	48	33		384.01
3	14	07	46	781	130°970		8	53	50	63		562.84	3	15	57	52	711	144°982		15	22	12	34		378.57
4	14	09	57	751	131°225		9	03	13	47		560.52	4	16	00	17	693	145°283		15	28	30	91		373.08
5	14	12	08	976	131°482		9	12	33	99		558.16	5	16	02	42	976	145°585		15	34	43	99		367.51
6	14	14	20	458	131°743		9	21	52	15		555.72	6	16	05	08	561	145°885		15	40	51	50		361.87
7	14	16	32	201	132°004		9	31	07	87		553.24	7	16	07	34	446	146°183		15	46	53	37		356.18
8	14	18	44	205	132°269		9	40	21	11		550.68	8	16	10	00	629	146°480		15	52	49	55		350.41
9	14	20	56	474	132°536		9	49	31	79		548.06	9	16	12	27	109	146°776		15	58	39	96		344.57
10	14	23	09	010	132°805		9	58	39	85		545.38	10	16	14	53	885	147°070		16	04	24	53		338.67
11	14	25	21	815	133°076		10	07	45	23		542.65	11	16	17	20	955	147°362		16	10	03	20		332.71
12	14	27	34	891	133°348		10	16	47	88		539.83	12	16	19	48	317	147°652		16	15	35	91		326.67
13	14	29	48	239	133°624		10	25	47	71		536.97	13	16	22	15	969	147°941		16	21	02	58		320.58
14	14	32	01	863	133°902		10	34	44	68		534.04	14	16	24	43	910	148°227		16	26	23	16		314.42
15	14	34	15	765	134°180		10	43	38	72		531.04	15	16	27	12	137	148°512		16	31	37	58		308.19
16	14	36	29	945	134°461		10	52	29	76		527.99	16	16	29	40	649	148°793		16	36	45	77		301.91
17	14	38	44	406	134°744		11	01	17	75		524.85	17	16	32	09	442	149°073		16	41	47	68		295.56
18	14	40	59	150	135°029		11	10	02	60		521.67	18	16	34	38	515	149°349		16	46	43	24		289.15
19	14	43	14	179	135°315		11	18	44	27		518.41	19	16	37	07	864	149°624		16	51	32	39		282.67
20	14	45	29	494	135°604		11	27	22	68		515.09	20	16	39	37	488	149°895		16	56	15	06		276.14
21	14	47	45	098	135°893		11	35	57	77		511.71	21	16	42	07	383	150°164		17	00	51	20		269.54
22	14	50	00	991	136°184		11	44	29	48		508.25	22	16	44	37	547	150°429		17	05	20	74		262.89
23	14	52	17	175	136°477		-11	52	57	73		-504.73	23	16	47	07	976	150°692		-17	09	43	63		-256.18
August 1									August 3																
0	14	54	33	652	136°772		-12	01	22	46		-501.15	0	16	49	38	668	150°951		-17	13	59	81		-249.41
1	14	56	50	424	137°067		12	09	43	61		497.49	1	16	52	09	619	151°207		17	18	09	22		242.58
2	14	59	07	491	137°363		12	18	01	10		493.77	2	16	54	40	826	151°459		17	22	11	80		235.70
3	15	01	24	854	137°662		12	26	14	87		489.99	3	16	57	12	285	151°708		17	26	07	50		228.76
4	15	03	42	516	137°961		12	34	24	86		486.14	4	16	59	43	993	151°954		17	29	56	26		221.76
5	15	06	00	477	138°262		12	42	31	00		482.21	5	17	02	15	947	152°195		17	33	38	02		214.72
6	15	08	18	739	138°563		12	50	33	21		478.22	6	17	04	48	142	152°432		17	37	12	74		207.62
7	15	10	37	302	138°865		12	58	31	43		474.16	7	17	07	20	574	152°666		17	40	40	36		200.46
8	15	12	56	167	139°169		13	06	25	59		470.04	8	17	09	53	240	152°895		17	44	00	82		193.27
9	15	15	15	336	139°472		13	14	15	63		465.84	9	17	12	26	135	153°120		17	47	14	09		186.01
10	15	17	34	808	139°778		13	22	01	47		461.57	10	17	14	59	255	153°341		17	50	20	10		178.71
11	15	19	54	586	140°082		13	29	43	04		457.25	11	17	17	32	596	153°558		17	53	18	81		171.37
12	15	22	14	668	140°389		13	37	20	29		452.85	12	17	20	06	154	153°769		17	56	10	18		163.97
13	15	24	35	057	140°695		13	44	53	14		448.37	13	17	22	39	923	153°977		17	58	54	15		156.53
14	15	26	55	752	141°001		13	52	21	51		443.84	14	17	25	13	900	154°179		18	01	30	68		149.05
15	15	29	16	753	141°309		13	59	45	35		439.23	15	17	27	48	079	154°377		18	03	59	73		141.52
16	15	31	38	062	141°616		14	07	04	58		434.55	16	17	30	22	456	154°569		18	06	21	25		133.96
17	15	33	59	678	141°923		14	14	19	13		429.81	17	17	32	57	025	154°757		18	08	35	21		126.35
18	15	36	21	601	142°231		14	21	28	94		425.00	18	17	35	31	782	154°940		18	10	41	56		118.70
19	15	38	43	832	142°538		14	28	33	94		420.11	19	17	38	06	722	155°117		18	12	40	26		111.03
20	15	41	06	370	142°845		14	35	34	05		415.16	20	17	40	41	839	155°289		18	14	31	29		103.30
21	15	43	29	215	143°151		14	42	29	21		410.14	21	17	43	17	128	155°456		18	16	14	59		95.55
22	15	45	52	366	143°459		14	49	19	35		405.05	22	17	45	52	584	155°617		18	17	50	14		87.76
23	15	48	15	825	143°764		14	56	04	40		-399.89	23	17	48	28	201	155°772		18	19	17	90		-79.95
24	15	50	39	589			-15	02	44	29			24	17	51	03	973		-18	20	37	85			

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
August 4							August 6						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	17 51	03.973	155.923	-18 20	37.85	72.09	0	19 56	43.846	155.830	-16 47	47.46	307.45
1	17 53	39.896	156.067	18 21	49.94	64.22	1	19 59	19.676	155.680	16 42	40.01	314.70
2	17 56	15.963	156.205	18 22	54.16	56.31	2	20 01	55.356	155.525	16 37	25.31	321.91
3	17 58	52.168	156.339	18 23	50.47	48.39	3	20 04	30.881	155.364	16 32	03.40	329.05
4	18 01	28.507	156.465	18 24	38.86	40.43	4	20 07	06.245	155.200	16 26	34.35	336.14
5	18 04	04.972	156.586	18 25	19.29	32.45	5	20 09	41.445	155.030	16 20	58.21	343.17
6	18 06	41.558	156.701	18 25	51.74	24.45	6	20 12	16.475	154.856	16 15	15.04	350.14
7	18 09	18.259	156.810	18 26	16.19	16.43	7	20 14	51.331	154.676	16 09	24.90	357.05
8	18 11	55.069	156.912	18 26	32.62	8.40	8	20 17	26.007	154.492	16 03	27.85	363.90
9	18 14	31.981	157.009	18 26	41.02	0.35	9	20 20	00.499	154.304	15 57	23.95	370.69
10	18 17	08.990	157.100	18 26	41.37	7.72	10	20 22	34.803	154.111	15 51	13.26	377.40
11	18 19	46.090	157.183	18 26	33.65	15.79	11	20 25	08.914	153.914	15 44	55.86	384.06
12	18 22	23.273	157.261	18 26	17.86	23.89	12	20 27	42.828	153.713	15 38	31.80	390.65
13	18 25	00.534	157.333	18 25	53.97	31.98	13	20 30	16.541	153.507	15 32	01.15	397.16
14	18 27	37.867	157.397	18 25	21.99	40.09	14	20 32	50.048	153.299	15 25	23.99	403.62
15	18 30	15.264	157.456	18 24	41.90	48.21	15	20 35	23.347	153.085	15 18	40.37	409.99
16	18 32	52.720	157.508	18 23	53.69	56.31	16	20 37	56.432	152.869	15 11	50.38	416.30
17	18 35	30.228	157.554	18 22	57.38	64.44	17	20 40	29.301	152.648	15 04	54.08	422.54
18	18 38	07.782	157.593	18 21	52.94	72.55	18	20 43	01.949	152.424	14 57	51.54	428.70
19	18 40	45.375	157.626	18 20	40.39	80.67	19	20 45	34.373	152.198	14 50	42.84	434.78
20	18 43	23.001	157.653	18 19	19.72	88.79	20	20 48	06.571	151.966	14 43	28.06	440.80
21	18 46	00.654	157.672	18 17	50.93	96.89	21	20 50	38.537	151.733	14 36	07.26	446.73
22	18 48	38.326	157.685	18 16	14.04	105.00	22	20 53	10.270	151.496	14 28	40.53	452.60
23	18 51	16.011	157.692	-18 14	29.04	+113.08	23	20 55	41.766	151.256	-14 21	07.93	+458.37
August 5							August 7						
0	18 53	53.703	157.692	-18 12	35.96	+121.18	0	20 58	13.022	151.013	-14 13	29.56	+464.08
1	18 56	31.395	157.686	18 10	34.78	129.24	1	21 00	44.035	150.768	14 05	45.48	469.70
2	18 59	09.081	157.674	18 08	25.54	137.30	2	21 03	14.803	150.520	13 57	55.78	475.24
3	19 01	46.755	157.654	18 06	08.24	145.34	3	21 05	45.323	150.270	13 50	00.54	480.71
4	19 04	24.409	157.629	18 03	42.90	153.36	4	21 08	15.593	150.017	13 41	59.83	486.09
5	19 07	02.038	157.597	18 01	09.54	161.37	5	21 10	45.610	149.761	13 33	53.74	491.39
6	19 09	39.635	157.558	17 58	28.17	169.35	6	21 13	15.371	149.504	13 25	42.35	496.60
7	19 12	17.193	157.514	17 55	38.82	177.31	7	21 15	44.875	149.245	13 17	25.75	501.75
8	19 14	54.707	157.463	17 52	41.51	185.24	8	21 18	14.120	148.983	13 09	04.00	506.79
9	19 17	32.170	157.406	17 49	36.27	193.16	9	21 20	43.103	148.720	13 00	37.21	511.76
10	19 20	09.576	157.342	17 46	23.11	201.03	10	21 23	11.823	148.456	12 52	05.45	516.64
11	19 22	46.918	157.272	17 43	02.08	208.89	11	21 25	40.279	148.188	12 43	28.81	521.45
12	19 25	24.190	157.197	17 39	33.19	216.70	12	21 28	08.467	147.921	12 34	47.36	526.15
13	19 28	01.387	157.114	17 35	56.49	224.49	13	21 30	36.388	147.650	12 26	01.21	530.79
14	19 30	38.501	157.027	17 32	12.00	232.24	14	21 33	04.038	147.381	12 17	10.42	535.32
15	19 33	15.528	156.933	17 28	19.76	239.96	15	21 35	31.419	147.108	12 08	15.10	539.79
16	19 35	52.461	156.833	17 24	19.80	247.63	16	21 37	58.527	146.834	11 59	15.31	544.15
17	19 38	29.294	156.727	17 20	12.17	255.26	17	21 40	25.361	146.561	11 50	11.16	548.44
18	19 41	06.021	156.616	17 15	56.91	262.86	18	21 42	51.922	146.286	11 41	02.72	552.63
19	19 43	42.637	156.498	17 11	34.05	270.40	19	21 45	18.208	146.010	11 31	50.09	556.75
20	19 46	19.135	156.376	17 07	03.65	277.91	20	21 47	44.218	145.733	11 22	33.34	560.77
21	19 48	55.511	156.248	17 02	25.74	285.37	21	21 50	09.951	145.456	11 13	12.57	564.70
22	19 51	31.759	156.113	16 57	40.37	292.78	22	21 52	35.407	145.179	11 03	47.87	568.56
23	19 54	07.872	155.974	16 52	47.59	+300.13	23	21 55	00.586	144.900	10 54	19.31	+572.32
24	19 56	43.846		-16 47	47.46		24	21 57	25.486		-10 44	46.99	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 8			August 10		
^h 0	^h 21 ^m 57 ^s 25.486 ^s	— 10 44 46.99	^h 0	^h 23 ^m 48 ^s 05.255 ^s	— 2 20 45.12
1	21 59 50.108 ^s	10 35 10.99	1	23 50 17.580 ^s	2 09 49.83
2	22 02 14.451 ^s	10 25 31.41	2	23 52 29.692 ^s	1 58 54.72
3	22 04 38.516 ^s	10 15 48.32	3	23 54 41.596 ^s	1 47 59.86
4	22 07 02.301 ^s	10 06 01.82	4	23 56 53.292 ^s	1 37 05.32
5	22 09 25.808 ^s	9 56 11.99	5	23 59 04.783 ^s	1 26 11.15
6	22 11 49.036 ^s	9 46 18.92	6	0 01 16.072 ^s	1 15 17.42
7	22 14 11.986 ^s	9 36 22.69	7	0 03 27.163 ^s	1 04 24.20
8	22 16 34.658 ^s	9 26 23.39	8	0 05 38.053 ^s	0 53 31.54
9	22 18 57.051 ^s	9 16 21.11	9	0 07 48.751 ^s	0 42 39.51
10	22 21 19.168 ^s	9 06 15.94	10	0 09 59.255 ^s	0 31 48.17
11	22 23 41.007 ^s	8 56 07.95	11	0 12 09.571 ^s	0 20 57.57
12	22 26 02.571 ^s	8 45 57.23	12	0 14 19.699 ^s	0 10 07.78
13	22 28 23.859 ^s	8 35 43.88	13	0 16 29.642 ^s	0 00 41.14
14	22 30 44.872 ^s	8 25 27.97	14	0 18 39.403 ^s	0 11 29.15
15	22 33 05.611 ^s	8 15 09.59	15	0 20 48.984 ^s	0 22 16.16
16	22 35 26.077 ^s	8 04 48.83	16	0 22 58.389 ^s	0 33 02.15
17	22 37 46.271 ^s	7 54 25.76	17	0 25 07.619 ^s	0 43 47.03
18	22 40 06.194 ^s	7 44 00.47	18	0 27 16.677 ^s	0 54 30.77
19	22 42 25.847 ^s	7 33 33.04	19	0 29 25.566 ^s	1 05 13.30
20	22 44 45.231 ^s	7 23 03.56	20	0 31 34.288 ^s	1 15 54.58
21	22 47 04.347 ^s	7 12 32.11	21	0 33 42.846 ^s	1 26 34.54
22	22 49 23.198 ^s	7 01 58.77	22	0 35 51.242 ^s	1 37 13.13
23	22 51 41.783 ^s	— 6 51 23.63	23	0 37 59.479 ^s	+ 1 47 50.31
		+ 636.87			+ 635.71
August 9			August 11		
0	22 54 00.105 ^s	— 6 40 46.76	0	0 40 07.560 ^s	+ 1 58 26.02
1	22 56 18.164 ^s	6 30 08.24	1	0 42 15.487 ^s	2 09 00.20
2	22 58 35.963 ^s	6 19 28.15	2	0 44 23.263 ^s	2 19 32.82
3	23 00 53.503 ^s	6 08 46.58	3	0 46 30.890 ^s	2 30 03.81
4	23 03 10.786 ^s	5 58 03.60	4	0 48 38.371 ^s	2 40 33.13
5	23 05 27.813 ^s	5 47 19.29	5	0 50 45.709 ^s	2 51 00.73
6	23 07 44.585 ^s	5 36 33.73	6	0 52 52.905 ^s	3 01 26.56
7	23 10 01.106 ^s	5 25 46.99	7	0 54 59.964 ^s	3 11 50.57
8	23 12 17.376 ^s	5 14 59.16	8	0 57 06.886 ^s	3 22 12.73
9	23 14 33.397 ^s	5 04 10.31	9	0 59 13.675 ^s	3 32 32.97
10	23 16 49.172 ^s	4 53 20.51	10	1 01 20.334 ^s	3 42 51.25
11	23 19 04.702 ^s	4 42 29.84	11	1 03 26.864 ^s	3 53 07.53
12	23 21 19.989 ^s	4 31 38.38	12	1 05 33.269 ^s	4 03 21.76
13	23 23 35.035 ^s	4 20 46.20	13	1 07 39.551 ^s	4 13 33.90
14	23 25 49.842 ^s	4 09 53.37	14	1 09 45.712 ^s	4 23 43.91
15	23 28 04.413 ^s	3 58 59.96	15	1 11 51.755 ^s	4 33 51.74
16	23 30 18.749 ^s	3 48 06.05	16	1 13 57.682 ^s	4 43 57.34
17	23 32 32.853 ^s	3 37 11.71	17	1 16 03.496 ^s	4 54 00.69
18	23 34 46.726 ^s	3 26 17.01	18	1 18 09.200 ^s	5 04 01.72
19	23 37 00.371 ^s	3 15 22.02	19	1 20 14.795 ^s	5 14 00.41
20	23 39 13.791 ^s	3 04 26.81	20	1 22 20.285 ^s	5 23 56.71
21	23 41 26.986 ^s	2 53 31.44	21	1 24 25.671 ^s	5 33 50.58
22	23 43 39.961 ^s	2 42 36.00	22	1 26 30.957 ^s	5 43 41.98
23	23 45 52.716 ^s	2 31 40.53	23	1 28 36.144 ^s	5 53 30.88
24	23 48 05.255 ^s	— 2 20 45.12	24	1 30 41.235 ^s	+ 6 03 17.23
		+ 655.41			+ 586.35

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 12			August 14		
0	1 30 41.235 ^s	+ 6 03 17.23 ["]	0	3 09 35.150 ^s	+12 51 28.51 ["]
1	1 32 46.233 ^s	6 13 00.99 ["]	1	3 11 38.079 ^s	12 58 30.78 ["]
2	1 34 51.139 ^s	6 22 42.13 ["]	2	3 13 41.007 ^s	13 05 29.05 ["]
3	1 36 55.956 ^s	6 32 20.61 ["]	3	3 15 43.934 ^s	13 12 23.28 ["]
4	1 39 00.687 ^s	6 41 56.40 ["]	4	3 17 46.861 ^s	13 19 13.46 ["]
5	1 41 05.333 ^s	6 51 29.44 ["]	5	3 19 49.791 ^s	13 25 59.58 ["]
6	1 43 09.898 ^s	7 00 59.72 ["]	6	3 21 52.723 ^s	13 32 41.59 ["]
7	1 45 14.382 ^s	7 10 27.19 ["]	7	3 23 55.660 ^s	13 39 19.50 ["]
8	1 47 18.790 ^s	7 19 51.83 ["]	8	3 25 58.602 ^s	13 45 53.27 ["]
9	1 49 23.122 ^s	7 29 13.58 ["]	9	3 28 01.550 ^s	13 52 22.82 ["]
10	1 51 27.381 ^s	7 38 32.42 ["]	10	3 30 04.506 ^s	13 58 48.38 ["]
11	1 53 31.569 ^s	7 47 48.32 ["]	11	3 32 07.470 ^s	14 05 09.57 ["]
12	1 55 35.689 ^s	7 57 01.24 ["]	12	3 34 10.443 ^s	14 11 26.60 ["]
13	1 57 39.743 ^s	8 06 11.15 ["]	13	3 36 13.427 ^s	14 17 39.40 ["]
14	1 59 43.732 ^s	8 15 18.02 ["]	14	3 38 16.422 ^s	14 23 47.95 ["]
15	2 01 47.660 ^s	8 24 21.80 ["]	15	3 40 19.429 ^s	14 29 52.22 ["]
16	2 03 51.527 ^s	8 33 22.48 ["]	16	3 42 22.449 ^s	14 35 52.21 ["]
17	2 05 55.336 ^s	8 42 20.02 ["]	17	3 44 25.484 ^s	14 41 47.88 ["]
18	2 07 59.090 ^s	8 51 14.38 ["]	18	3 46 28.533 ^s	14 47 39.23 ["]
19	2 10 02.790 ^s	9 00 05.55 ["]	19	3 48 31.597 ^s	14 53 26.24 ["]
20	2 12 06.439 ^s	9 08 53.47 ["]	20	3 50 34.678 ^s	14 59 08.88 ["]
21	2 14 10.037 ^s	9 17 38.14 ["]	21	3 52 37.776 ^s	15 04 47.14 ["]
22	2 16 13.588 ^s	9 26 19.51 ["]	22	3 54 40.892 ^s	15 10 21.00 ["]
23	2 18 17.094 ^s	+ 9 34 57.55 ["]	23	3 56 44.026 ^s	+15 15 50.45 ["]
	123.462	+514.69		123.153	+325.02
August 13			August 15		
0	2 20 20.556 ^s	+ 9 43 32.24 ["]	0	3 58 47.179 ^s	+15 21 15.47 ["]
1	2 22 23.975 ^s	9 52 03.56 ["]	1	4 00 50.352 ^s	15 26 36.03 ["]
2	2 24 27.355 ^s	10 00 31.46 ["]	2	4 02 53.546 ^s	15 31 52.13 ["]
3	2 26 30.697 ^s	10 08 55.92 ["]	3	4 04 56.760 ^s	15 37 03.75 ["]
4	2 28 34.003 ^s	10 17 16.91 ["]	4	4 06 59.995 ^s	15 42 10.87 ["]
5	2 30 37.274 ^s	10 25 34.42 ["]	5	4 09 03.253 ^s	15 47 13.48 ["]
6	2 32 40.513 ^s	10 33 48.40 ["]	6	4 11 06.533 ^s	15 52 11.55 ["]
7	2 34 43.721 ^s	10 41 58.83 ["]	7	4 13 09.835 ^s	15 57 05.08 ["]
8	2 36 46.900 ^s	10 50 05.68 ["]	8	4 15 13.161 ^s	16 01 54.05 ["]
9	2 38 50.051 ^s	10 58 08.94 ["]	9	4 17 16.510 ^s	16 06 38.45 ["]
10	2 40 53.177 ^s	11 06 08.57 ["]	10	4 19 19.884 ^s	16 11 18.25 ["]
11	2 42 56.279 ^s	11 14 04.54 ["]	11	4 21 23.281 ^s	16 15 53.44 ["]
12	2 44 59.359 ^s	11 21 56.84 ["]	12	4 23 26.704 ^s	16 20 24.02 ["]
13	2 47 02.419 ^s	11 29 45.43 ["]	13	4 25 30.151 ^s	16 24 49.96 ["]
14	2 49 05.459 ^s	11 37 30.29 ["]	14	4 27 33.623 ^s	16 29 11.25 ["]
15	2 51 08.482 ^s	11 45 11.40 ["]	15	4 29 37.121 ^s	16 33 27.88 ["]
16	2 53 11.489 ^s	11 52 48.73 ["]	16	4 31 40.644 ^s	16 37 39.83 ["]
17	2 55 14.481 ^s	12 00 22.25 ["]	17	4 33 44.192 ^s	16 41 47.10 ["]
18	2 57 17.461 ^s	12 07 51.96 ["]	18	4 35 47.767 ^s	16 45 49.65 ["]
19	2 59 20.429 ^s	12 15 17.81 ["]	19	4 37 51.367 ^s	16 49 47.50 ["]
20	3 01 23.387 ^s	12 22 39.79 ["]	20	4 39 54.994 ^s	16 53 40.61 ["]
21	3 03 26.337 ^s	12 29 57.87 ["]	21	4 41 58.646 ^s	16 57 28.98 ["]
22	3 05 29.280 ^s	12 37 12.03 ["]	22	4 44 02.325 ^s	17 01 12.60 ["]
23	3 07 32.217 ^s	12 44 22.25 ["]	23	4 46 06.029 ^s	17 04 51.45 ["]
24	3 09 35.150 ^s	+12 51 28.51 ["]	24	4 48 09.760 ^s	+17 08 25.53 ["]
	122.933	+426.26		123.731	+214.08

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
August 16							August 18						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	4 48	09.760		+17 08	25.53	+209.28	0	6 27	32.963		+18 23	07.11	
1	4 50	13.516	123.756	17 11	54.81	204.48	1	6 29	37.462	124.499	18 22	37.48	- 29.63
2	4 52	17.299	123.783	17 15	19.29	199.67	2	6 31	41.958	124.496	18 22	02.79	34.69
3	4 54	21.107	123.808	17 18	38.96	194.85	3	6 33	46.452	124.494	18 21	23.04	39.75
4	4 56	24.941	123.834	17 21	53.81	190.01	4	6 35	50.942	124.490	18 20	38.25	44.79
5	4 58	28.800	123.859	17 25	03.82	185.16	5	6 37	55.427	124.485	18 19	48.40	49.85
6	5 00	32.685	123.885	17 28	08.98	180.31	6	6 39	59.906	124.479	18 18	53.51	54.89
7	5 02	36.595	123.910	17 31	09.29	175.45	7	6 42	04.379	124.473	18 17	53.58	59.93
8	5 04	40.529	123.934	17 34	04.74	170.56	8	6 44	08.844	124.465	18 16	48.61	64.79
9	5 06	44.488	123.959	17 36	55.30	165.69	9	6 46	13.301	124.457	18 15	38.60	70.01
10	5 08	48.472	123.984	17 39	40.99	160.79	10	6 48	17.748	124.447	18 14	23.57	75.03
11	5 10	52.479	124.007	17 42	21.78	155.88	11	6 50	22.185	124.437	18 13	03.50	80.07
12	5 12	56.511	124.032	17 44	57.66	150.97	12	6 52	26.610	124.425	18 11	38.41	85.09
13	5 15	00.565	124.054	17 47	28.63	146.05	13	6 54	31.024	124.414	18 10	08.30	90.11
14	5 17	04.643	124.078	17 49	54.68	141.12	14	6 56	35.424	124.400	18 08	33.18	95.12
15	5 19	08.743	124.100	17 52	15.80	136.18	15	6 58	39.811	124.387	18 06	53.06	100.12
16	5 21	12.865	124.122	17 54	31.98	131.24	16	7 00	44.182	124.371	18 05	07.93	105.13
17	5 23	17.009	124.144	17 56	43.22	126.28	17	7 02	48.538	124.356	18 03	17.81	110.12
18	5 25	21.174	124.165	17 58	49.50	121.32	18	7 04	52.877	124.339	18 01	22.70	115.11
19	5 27	25.360	124.186	18 00	50.82	116.35	19	7 06	57.198	124.321	17 59	22.61	120.09
20	5 29	29.566	124.206	18 02	47.17	111.38	20	7 09	01.501	124.303	17 57	17.55	125.06
21	5 31	33.791	124.225	18 04	38.55	106.39	21	7 11	05.784	124.283	17 55	07.52	130.03
22	5 33	38.036	124.245	18 06	24.94	101.41	22	7 13	10.047	124.263	17 52	52.53	134.99
23	5 35	42.300	124.264	+18 08	06.35	+96.41	23	7 15	14.288	124.241	+17 50	32.60	-144.88
			124.282							124.220			
August 17							August 19						
0	5 37	46.582		+18 09	42.76	+91.41	0	7 17	18.508		+17 48	07.72	-149.81
1	5 39	50.881	124.299	18 11	14.17	86.40	1	7 19	22.704	124.196	17 45	37.91	154.73
2	5 41	55.197	124.316	18 12	40.57	81.40	2	7 21	26.877	124.173	17 43	03.18	159.64
3	5 43	59.529	124.332	18 14	01.97	76.37	3	7 23	31.025	124.148	17 40	23.54	164.54
4	5 46	03.877	124.348	18 15	18.34	71.36	4	7 25	35.148	124.123	17 37	39.00	169.44
5	5 48	08.239	124.362	18 16	29.70	66.33	5	7 27	39.244	124.096	17 34	49.56	174.32
6	5 50	12.616	124.377	18 17	36.03	61.30	6	7 29	43.313	124.069	17 31	55.24	179.16
7	5 52	17.006	124.390	18 18	37.33	56.26	7	7 31	47.354	124.041	17 28	56.06	184.05
8	5 54	21.409	124.403	18 19	33.59	51.23	8	7 33	51.367	124.013	17 25	52.01	188.90
9	5 56	25.824	124.415	18 20	24.82	46.19	9	7 35	55.350	123.983	17 22	43.11	193.72
10	5 58	30.251	124.427	18 21	11.01	41.14	10	7 37	59.302	123.952	17 19	29.39	198.56
11	6 00	34.688	124.437	18 21	52.15	36.09	11	7 40	03.223	123.921	17 16	10.83	203.36
12	6 02	39.135	124.447	18 22	28.24	31.05	12	7 42	07.113	123.890	17 12	47.47	208.16
13	6 04	43.590	124.455	18 22	59.29	26.00	13	7 44	10.970	123.857	17 09	19.31	212.94
14	6 06	48.054	124.464	18 23	25.29	20.94	14	7 46	14.793	123.823	17 05	46.37	217.71
15	6 08	52.526	124.472	18 23	46.23	15.88	15	7 48	18.583	123.790	17 02	08.66	222.47
16	6 10	57.004	124.478	18 24	02.11	10.83	16	7 50	22.338	123.755	16 58	26.19	227.21
17	6 13	01.487	124.483	18 24	12.94	5.77	17	7 52	26.057	123.719	16 54	38.98	231.93
18	6 15	05.976	124.489	18 24	18.71	0.72	18	7 54	29.740	123.683	16 50	47.05	236.64
19	6 17	10.469	124.493	18 24	19.43	4.35	19	7 56	33.387	123.647	16 46	50.41	241.34
20	6 19	14.965	124.496	18 24	15.08	9.40	20	7 58	36.997	123.610	16 42	49.07	246.02
21	6 21	19.463	124.498	18 24	05.68	14.47	21	8 00	40.568	123.571	16 38	43.05	250.68
22	6 23	23.963	124.500	18 23	51.21	19.52	22	8 02	44.101	123.533	16 34	32.37	255.33
23	6 25	28.463	124.500	18 23	31.69	24.58	23	8 04	47.595	123.494	16 30	17.04	259.96
24	6 27	32.963		+18 23	07.11		24	8 06	51.049	123.454	+16 25	57.08	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 20			August 22		
0	8 06 51.049 ^s 123.415	+16 25 57.08 ["] 264.57	0	9 44 44.919 ^s 121.307	+11 34 05.49 ["] 459.51
1	8 08 54.464 ^s 123.373	16 21 32.51 ["] 269.17	1	9 46 46.226 ^s 121.270	11 26 25.98 ["] 462.90
2	8 10 57.837 ^s 123.332	16 17 03.34 ["] 273.74	2	9 48 47.496 ^s 121.234	11 18 43.08 ["] 466.26
3	8 13 01.169 ^s 123.291	16 12 29.60 ["] 278.31	3	9 50 48.730 ^s 121.199	11 10 56.82 ["] 469.58
4	8 15 04.460 ^s 123.249	16 07 51.29 ["] 282.84	4	9 52 49.929 ^s 121.163	11 03 07.24 ["] 472.88
5	8 17 07.709 ^s 123.206	16 03 08.45 ["] 287.36	5	9 54 51.092 ^s 121.129	10 55 14.36 ["] 476.13
6	8 19 10.915 ^s 123.163	15 58 21.09 ["] 291.87	6	9 56 52.221 ^s 121.096	10 47 18.23 ["] 479.35
7	8 21 14.078 ^s 123.120	15 53 29.22 ["] 296.35	7	9 58 53.317 ^s 121.064	10 39 18.88 ["] 482.54
8	8 23 17.198 ^s 123.076	15 48 32.87 ["] 300.82	8	10 00 54.381 ^s 121.032	10 31 16.34 ["] 485.71
9	8 25 20.274 ^s 123.032	15 43 32.05 ["] 305.25	9	10 02 55.413 ^s 121.002	10 23 10.63 ["] 488.82
10	8 27 23.306 ^s 122.987	15 38 26.80 ["] 309.68	10	10 04 56.415 ^s 120.972	10 15 01.81 ["] 491.92
11	8 29 26.293 ^s 122.943	15 33 17.12 ["] 314.09	11	10 06 57.387 ^s 120.943	10 06 49.89 ["] 494.97
12	8 31 29.236 ^s 122.898	15 28 03.03 ["] 318.46	12	10 08 58.330 ^s 120.916	9 58 34.92 ["] 497.99
13	8 33 32.134 ^s 122.853	15 22 44.57 ["] 322.82	13	10 10 59.246 ^s 120.889	9 50 16.93 ["] 500.98
14	8 35 34.987 ^s 122.807	15 17 21.75 ["] 327.16	14	10 13 00.135 ^s 120.864	9 41 55.95 ["] 503.93
15	8 37 37.794 ^s 122.762	15 11 54.59 ["] 331.48	15	10 15 00.999 ^s 120.839	9 33 32.02 ["] 506.84
16	8 39 40.556 ^s 122.716	15 06 23.11 ["] 335.76	16	10 17 01.838 ^s 120.815	9 25 05.18 ["] 509.73
17	8 41 43.272 ^s 122.669	15 00 47.35 ["] 340.04	17	10 19 02.653 ^s 120.794	9 16 35.45 ["] 512.57
18	8 43 45.941 ^s 122.624	14 55 07.31 ["] 344.29	18	10 21 03.447 ^s 120.772	9 08 02.88 ["] 515.37
19	8 45 48.565 ^s 122.578	14 49 23.02 ["] 348.51	19	10 23 04.219 ^s 120.753	8 59 27.51 ["] 518.15
20	8 47 51.143 ^s 122.531	14 43 34.51 ["] 352.71	20	10 25 04.972 ^s 120.733	8 50 49.36 ["] 520.89
21	8 49 53.674 ^s 122.484	14 37 41.80 ["] 356.89	21	10 27 05.705 ^s 120.717	8 42 08.47 ["] 523.58
22	8 51 56.158 ^s 122.439	14 31 44.91 ["] 361.03	22	10 29 06.422 ^s 120.700	8 33 24.89 ["] 526.25
23	8 53 58.597 ^s 122.392	+14 25 43.88 ["] -365.17	23	10 31 07.122 ^s 120.685	+ 8 24 38.64 ["] -528.87
August 21			August 23		
0	8 56 00.989 ^s 122.345	+14 19 38.71 ["] -369.27	0	10 33 07.807 ^s 120.671	+ 8 15 49.77 ["] -531.46
1	8 58 03.334 ^s 122.299	14 13 29.44 ["] 373.35	1	10 35 08.478 ^s 120.660	8 06 58.31 ["] 534.01
2	9 00 05.633 ^s 122.253	14 07 16.09 ["] 377.39	2	10 37 09.138 ^s 120.648	7 58 04.30 ["] 536.52
3	9 02 07.886 ^s 122.207	14 00 58.70 ["] 381.43	3	10 39 09.786 ^s 120.639	7 49 07.78 ["] 539.00
4	9 04 10.093 ^s 122.161	13 54 37.27 ["] 385.42	4	10 41 10.425 ^s 120.631	7 40 08.78 ["] 541.43
5	9 06 12.254 ^s 122.114	13 48 11.85 ["] 389.40	5	10 43 11.056 ^s 120.624	7 31 07.35 ["] 543.83
6	9 08 14.368 ^s 122.069	13 41 42.45 ["] 393.35	6	10 45 11.680 ^s 120.619	7 22 03.52 ["] 546.19
7	9 10 16.437 ^s 122.024	13 35 09.10 ["] 397.27	7	10 47 12.299 ^s 120.615	7 12 57.33 ["] 548.51
8	9 12 18.461 ^s 121.978	13 28 31.83 ["] 401.15	8	10 49 12.914 ^s 120.613	7 03 48.82 ["] 550.79
9	9 14 20.439 ^s 121.933	13 21 50.68 ["] 405.03	9	10 51 13.527 ^s 120.612	6 54 38.03 ["] 553.04
10	9 16 22.372 ^s 121.889	13 15 05.65 ["] 408.86	10	10 53 14.139 ^s 120.613	6 45 24.99 ["] 555.24
11	9 18 24.261 ^s 121.844	13 08 16.79 ["] 412.68	11	10 55 14.752 ^s 120.615	6 36 09.75 ["] 557.40
12	9 20 26.105 ^s 121.800	13 01 24.11 ["] 416.45	12	10 57 15.367 ^s 120.620	6 26 52.35 ["] 559.53
13	9 22 27.905 ^s 121.756	12 54 27.66 ["] 420.21	13	10 59 15.987 ^s 120.625	6 17 32.82 ["] 561.61
14	9 24 29.661 ^s 121.713	12 47 27.45 ["] 423.93	14	11 01 16.612 ^s 120.633	6 08 11.21 ["] 563.65
15	9 26 31.374 ^s 121.670	12 40 23.52 ["] 427.62	15	11 03 17.245 ^s 120.641	5 58 47.56 ["] 565.66
16	9 28 33.044 ^s 121.627	12 33 15.90 ["] 431.29	16	11 05 17.886 ^s 120.652	5 49 21.90 ["] 567.62
17	9 30 34.671 ^s 121.586	12 26 04.61 ["] 434.93	17	11 07 18.538 ^s 120.665	5 39 54.28 ["] 569.54
18	9 32 36.257 ^s 121.543	12 18 49.68 ["] 438.53	18	11 09 19.203 ^s 120.678	5 30 24.74 ["] 571.42
19	9 34 37.801 ^s 121.500	12 11 31.15 ["] 442.10	19	11 11 19.881 ^s 120.694	5 20 53.32 ["] 573.26
20	9 36 39.304 ^s 121.463	12 04 09.05 ["] 445.65	20	11 13 20.575 ^s 120.712	5 11 20.06 ["] 575.06
21	9 38 40.767 ^s 121.423	11 56 43.40 ["] 449.16	21	11 15 21.287 ^s 120.732	5 01 45.00 ["] 576.82
22	9 40 42.190 ^s 121.383	11 49 14.24 ["] 452.65	22	11 17 22.019 ^s 120.752	4 52 08.18 ["] 578.53
23	9 42 43.573 ^s 121.346	11 41 41.59 ["] 456.10	23	11 19 22.771 ^s 120.776	4 42 29.65 ["] -580.20
24	9 44 44.919 ^s	+11 34 05.49 ["]	24	11 21 23.547 ^s	+ 4 32 49.45 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
August 24							August 26						
h	m	s		°	'	"	h	m	s		°	'	"
0	11	21	23.547 ^s	+	4	32 49.45 ^s	0	12	59	07.988 ^s	-	3	29 37.82 ^s
1	11	23	24.347 ^{120.800}		4	23 07.61 ^{581.84}	1	13	01	12.467 ^{124.479}		3	39 44.65 ^{-606.83}
2	11	25	25.175 ^{120.828}		4	13 24.19 ^{583.42}	2	13	03	17.079 ^{124.612}		3	49 50.83 ^{-606.18}
3	11	27	26.030 ^{120.855}		4	03 39.22 ^{584.97}	3	13	05	21.826 ^{124.747}		3	59 56.28 ^{605.45}
4	11	29	26.917 ^{120.887}		3	53 52.75 ^{586.47}	4	13	07	26.711 ^{124.885}		4	10 00.97 ^{604.69}
5	11	31	27.836 ^{120.919}		3	44 04.81 ^{587.94}	5	13	09	31.735 ^{125.024}		4	20 04.83 ^{603.88}
6	11	33	28.789 ^{120.953}		3	34 15.47 ^{589.34}	6	13	11	36.902 ^{125.167}		4	30 07.82 ^{602.99}
7	11	35	29.779 ^{120.990}		3	24 24.74 ^{590.73}	7	13	13	42.213 ^{125.311}		4	40 09.89 ^{602.07}
8	11	37	30.807 ^{121.028}		3	14 32.69 ^{592.05}	8	13	15	47.671 ^{125.458}		4	50 10.98 ^{601.09}
9	11	39	31.876 ^{121.069}		3	04 39.35 ^{593.34}	9	13	17	53.278 ^{125.607}		5	00 11.03 ^{600.05}
10	11	41	32.987 ^{121.111}		2	54 44.77 ^{594.58}	10	13	19	59.037 ^{125.759}		5	10 10.01 ^{598.98}
11	11	43	34.143 ^{121.156}		2	44 48.99 ^{595.78}	11	13	22	04.950 ^{125.913}		5	20 07.85 ^{597.84}
12	11	45	35.345 ^{121.202}		2	34 52.05 ^{596.94}	12	13	24	11.019 ^{126.069}		5	30 04.49 ^{596.64}
13	11	47	36.595 ^{121.250}		2	24 54.01 ^{598.04}	13	13	26	17.246 ^{126.227}		5	39 59.90 ^{595.41}
14	11	49	37.896 ^{121.301}		2	14 54.90 ^{599.11}	14	13	28	23.635 ^{126.389}		5	49 54.01 ^{594.11}
15	11	51	39.250 ^{121.354}		2	04 54.77 ^{600.13}	15	13	30	30.186 ^{126.551}		5	59 46.76 ^{592.75}
16	11	53	40.659 ^{121.409}		1	54 53.66 ^{601.11}	16	13	32	36.903 ^{126.717}		6	09 38.11 ^{591.35}
17	11	55	42.125 ^{121.466}		1	44 51.62 ^{602.04}	17	13	34	43.788 ^{126.885}		6	19 28.00 ^{589.89}
18	11	57	43.650 ^{121.525}		1	34 48.70 ^{602.92}	18	13	36	50.842 ^{127.054}		6	29 16.38 ^{588.38}
19	11	59	45.236 ^{121.586}		1	24 44.94 ^{603.76}	19	13	38	58.069 ^{127.227}		6	39 03.19 ^{586.81}
20	12	01	46.886 ^{121.650}		1	14 40.39 ^{604.55}	20	13	41	05.470 ^{127.401}		6	48 48.38 ^{585.19}
21	12	03	48.601 ^{121.715}		1	04 35.08 ^{605.31}	21	13	43	13.048 ^{127.578}		6	58 31.89 ^{583.51}
22	12	05	50.385 ^{121.784}		0	54 29.08 ^{606.00}	22	13	45	20.805 ^{127.757}		7	08 13.66 ^{581.77}
23	12	07	52.238 ^{121.853}	+	0	44 22.42 ^{606.66}	23	13	47	28.743 ^{127.938}	-	7	17 53.65 ^{579.99}
			^{121.925}			^{-607.27}				^{128.122}			^{-578.14}
August 25							August 27						
0	12	09	54.163 ^{122.000}	+	0	34 15.15 ^{-607.83}	0	13	49	36.865 ^{128.306}	-	7	27 31.79 ^{-576.25}
1	12	11	56.163 ^{122.077}		0	24 07.32 ^{608.34}	1	13	51	45.171 ^{128.495}		7	37 08.04 ^{574.29}
2	12	13	58.240 ^{122.155}		0	13 58.98 ^{608.82}	2	13	53	53.666 ^{128.684}		7	46 42.33 ^{572.27}
3	12	16	00.395 ^{122.237}	+	0	03 50.16 ^{609.23}	3	13	56	02.350 ^{128.875}		7	56 14.60 ^{570.21}
4	12	18	02.632 ^{122.321}	-	0	06 19.07 ^{609.61}	4	13	58	11.225 ^{129.070}		8	05 44.81 ^{568.08}
5	12	20	04.953 ^{122.406}		0	16 28.68 ^{609.94}	5	14	00	20.295 ^{129.265}		8	15 12.89 ^{565.91}
6	12	22	07.359 ^{122.494}		0	26 38.62 ^{610.21}	6	14	02	29.560 ^{129.464}		8	24 38.80 ^{563.66}
7	12	24	09.853 ^{122.585}		0	36 48.83 ^{610.44}	7	14	04	39.024 ^{129.663}		8	34 02.46 ^{561.37}
8	12	26	12.438 ^{122.677}		0	46 59.27 ^{610.63}	8	14	06	48.687 ^{129.866}		8	43 23.83 ^{559.02}
9	12	28	15.115 ^{122.772}		0	57 09.90 ^{610.76}	9	14	08	58.553 ^{130.069}		8	52 42.85 ^{556.61}
10	12	30	17.887 ^{122.870}		1	07 20.66 ^{610.84}	10	14	11	08.622 ^{130.275}		9	01 59.46 ^{554.14}
11	12	32	20.757 ^{122.969}		1	17 31.50 ^{610.88}	11	14	13	18.897 ^{130.483}		9	11 13.60 ^{551.62}
12	12	34	23.726 ^{123.072}		1	27 42.38 ^{610.87}	12	14	15	29.380 ^{130.692}		9	20 25.22 ^{549.04}
13	12	36	26.798 ^{123.175}		1	37 53.25 ^{610.81}	13	14	17	40.072 ^{130.904}		9	29 34.26 ^{546.40}
14	12	38	29.973 ^{123.283}		1	48 04.06 ^{610.70}	14	14	19	50.976 ^{131.116}		9	38 40.66 ^{543.70}
15	12	40	33.256 ^{123.391}		1	58 14.76 ^{610.53}	15	14	22	02.092 ^{131.332}		9	47 44.36 ^{540.95}
16	12	42	36.647 ^{123.503}		2	08 25.29 ^{610.33}	16	14	24	13.424 ^{131.549}		9	56 45.31 ^{538.13}
17	12	44	40.150 ^{123.617}		2	18 35.62 ^{610.07}	17	14	26	24.973 ^{131.767}		10	05 43.44 ^{535.26}
18	12	46	43.767 ^{123.732}		2	28 45.69 ^{609.75}	18	14	28	36.740 ^{131.988}		10	14 38.70 ^{532.32}
19	12	48	47.499 ^{123.852}		2	38 55.44 ^{609.40}	19	14	30	48.728 ^{132.209}		10	23 31.02 ^{529.34}
20	12	50	51.351 ^{123.972}		2	49 04.84 ^{608.99}	20	14	33	00.937 ^{132.432}		10	32 20.36 ^{526.29}
21	12	52	55.323 ^{124.095}		2	59 13.83 ^{608.52}	21	14	35	13.369 ^{132.657}		10	41 06.65 ^{523.18}
22	12	54	59.418 ^{124.221}		3	09 22.35 ^{608.02}	22	14	37	26.026 ^{132.884}		10	49 49.83 ^{520.02}
23	12	57	03.639 ^{124.349}		3	19 30.37 ^{-607.45}	23	14	39	38.910 ^{133.112}		10	58 29.85 ^{-516.79}
24	12	59	07.988	-	3	29 37.82	24	14	41	52.022	-	11	07 06.64

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension		Apparent Declination		Hour	Apparent Right Ascension		Apparent Declination	
August 28					August 30				
h	m	s	°	'	h	m	s	°	'
0	14 41	52.022	133°34.1	11 07 06.64	0	16 33 05.452	144°954	16 37 55.70	144°954
1	14 44	05.363	133°57.2	11 15 40.15	1	16 35 30.406	145°180	16 42 42.14	145°180
2	14 46	18.935	133°80.4	11 24 10.31	2	16 37 55.586	145°405	16 47 22.47	145°405
3	14 48	32.739	134°03.8	11 32 37.07	3	16 40 20.991	145°628	16 51 56.63	145°628
4	14 50	46.777	134°27.2	11 41 00.37	4	16 42 46.619	145°849	16 56 24.58	145°849
5	14 53	01.049	134°50.8	11 49 20.14	5	16 45 12.468	146°067	17 00 46.26	146°067
6	14 55	15.557	134°74.6	11 57 36.34	6	16 47 38.535	146°283	17 05 01.63	146°283
7	14 57	30.303	134°98.3	12 05 48.89	7	16 50 04.818	146°498	17 09 10.64	146°498
8	14 59	45.286	135°22.3	12 13 57.74	8	16 52 31.316	146°708	17 13 13.24	146°708
9	15 02	00.509	135°46.3	12 22 02.83	9	16 54 58.024	146°918	17 17 09.39	146°918
10	15 04	15.972	135°70.4	12 30 04.10	10	16 57 24.942	147°124	17 20 59.03	147°124
11	15 06	31.676	135°94.6	12 38 01.49	11	16 59 52.066	147°328	17 24 42.13	147°328
12	15 08	47.622	136°18.9	12 45 54.94	12	17 02 19.394	147°529	17 28 18.63	147°529
13	15 11	03.811	136°43.3	12 53 44.39	13	17 04 46.923	147°728	17 31 48.49	147°728
14	15 13	20.244	136°67.8	13 01 29.78	14	17 07 14.651	147°922	17 35 11.68	147°922
15	15 15	36.922	136°92.3	13 09 11.05	15	17 09 42.573	148°115	17 38 28.14	148°115
16	15 17	53.845	137°16.8	13 16 48.14	16	17 12 10.688	148°304	17 41 37.83	148°304
17	15 20	11.013	137°41.5	13 24 20.99	17	17 14 38.992	148°490	17 44 40.72	148°490
18	15 22	28.428	137°66.2	13 31 49.54	18	17 17 07.482	148°674	17 47 36.76	148°674
19	15 24	46.090	137°90.9	13 39 13.73	19	17 19 36.156	148°852	17 50 25.91	148°852
20	15 27	03.999	138°15.7	13 46 33.51	20	17 22 05.008	149°030	17 53 08.14	149°030
21	15 29	22.156	138°40.5	13 53 48.81	21	17 24 34.038	149°202	17 55 43.41	149°202
22	15 31	40.561	138°65.3	14 00 59.57	22	17 27 03.240	149°371	17 58 11.68	149°371
23	15 33	59.214	138°90.1	14 08 05.73	23	17 29 32.611	149°537	18 00 32.91	149°537
August 29					August 31				
0	15 36	18.115	139°15.0	14 15 07.24	0	17 32 02.148	149°700	18 02 47.07	149°700
1	15 38	37.265	139°39.9	14 22 04.03	1	17 34 31.848	149°857	18 04 54.13	149°857
2	15 40	56.664	139°64.7	14 28 56.05	2	17 37 01.705	150°013	18 06 54.06	150°013
3	15 43	16.311	139°89.5	14 35 43.23	3	17 39 31.718	150°163	18 08 46.81	150°163
4	15 45	36.206	140°14.4	14 42 25.52	4	17 42 01.881	150°310	18 10 32.36	150°310
5	15 47	56.350	140°39.1	14 49 02.87	5	17 44 32.191	150°453	18 12 10.69	150°453
6	15 50	16.741	140°63.9	14 55 35.20	6	17 47 02.644	150°592	18 13 41.76	150°592
7	15 52	37.380	140°88.7	15 02 02.47	7	17 49 33.236	150°727	18 15 05.54	150°727
8	15 54	58.267	141°13.3	15 08 24.61	8	17 52 03.963	150°857	18 16 22.01	150°857
9	15 57	19.400	141°37.9	15 14 41.57	9	17 54 34.820	150°984	18 17 31.14	150°984
10	15 59	40.779	141°62.5	15 20 53.29	10	17 57 05.804	151°106	18 18 32.92	151°106
11	16 02	02.404	141°87.0	15 26 59.71	11	17 59 36.910	151°224	18 19 27.30	151°224
12	16 04	24.274	142°11.4	15 33 00.78	12	18 02 08.134	151°338	18 20 14.28	151°338
13	16 06	46.388	142°35.7	15 38 56.44	13	18 04 39.472	151°446	18 20 53.84	151°446
14	16 09	08.745	142°60.0	15 44 46.63	14	18 07 10.918	151°552	18 21 25.94	151°552
15	16 11	31.345	142°84.1	15 50 31.30	15	18 09 42.470	151°651	18 21 50.58	151°651
16	16 13	54.186	143°08.1	15 56 10.39	16	18 12 14.121	151°747	18 22 07.74	151°747
17	16 16	17.267	143°32.0	16 01 43.84	17	18 14 45.868	151°839	18 22 17.40	151°839
18	16 18	40.587	143°55.8	16 07 11.61	18	18 17 17.707	151°924	18 22 19.55	151°924
19	16 21	04.145	143°79.5	16 12 33.63	19	18 19 49.631	152°007	18 22 14.17	152°007
20	16 23	27.940	144°02.9	16 17 49.85	20	18 22 21.638	152°084	18 22 01.25	152°084
21	16 25	51.969	144°26.3	16 23 00.23	21	18 24 53.722	152°156	18 21 40.78	152°156
22	16 28	16.232	144°49.5	16 28 04.69	22	18 27 25.878	152°223	18 21 12.76	152°223
23	16 30	40.727	144°72.5	16 33 03.20	23	18 29 58.101	152°287	18 20 37.16	152°287
24	16 33	05.452		16 37 55.70	24	18 32 30.388		18 19 54.00	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
September 1							September 3						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	18 32	30.388	^s	-18 19	54.00	["]	0	20 34	01.031	^s	-15 20	24.35	["]
1	18 35	02.733	152.345	18 19	03.26	+ 50.74	1	20 36	30.711	149.680	15 13	50.18	+ 394.17
2	18 37	35.131	152.398	18 18	04.93	58.33	2	20 39	00.236	149.525	15 07	09.81	400.37
3	18 40	07.578	152.447	18 16	59.01	65.92	3	20 41	29.605	149.369	15 00	23.31	406.50
4	18 42	40.069	152.491	18 15	45.51	73.50	4	20 43	58.814	149.209	14 53	30.74	412.57
5	18 45	12.598	152.529	18 14	24.43	81.08	5	20 46	27.860	149.046	14 46	32.15	418.59
6	18 47	45.161	152.563	18 12	55.75	88.68	6	20 48	56.740	148.880	14 39	27.61	424.54
7	18 50	17.754	152.593	18 11	19.50	96.25	7	20 51	25.452	148.712	14 32	17.17	430.44
8	18 52	50.371	152.617	18 09	35.66	103.84	8	20 53	53.993	148.541	14 25	00.92	436.25
9	18 55	23.007	152.636	18 07	44.25	111.41	9	20 56	22.360	148.367	14 17	38.90	442.02
10	18 57	55.658	152.651	18 05	45.27	118.98	10	20 58	50.551	148.191	14 10	11.18	447.72
11	19 00	28.318	152.660	18 03	38.74	126.53	11	21 01	18.564	148.013	14 02	37.83	453.35
12	19 03	00.983	152.665	18 01	24.65	134.09	12	21 03	46.396	147.832	13 54	58.92	458.91
13	19 05	33.648	152.665	17 59	03.03	141.62	13	21 06	14.046	147.650	13 47	14.51	464.41
14	19 08	06.308	152.660	17 56	33.88	149.15	14	21 08	41.510	147.464	13 39	24.67	469.84
15	19 10	38.958	152.650	17 53	57.21	156.67	15	21 11	08.787	147.277	13 31	29.47	475.20
16	19 13	11.594	152.636	17 51	13.06	164.15	16	21 13	35.875	147.088	13 23	28.98	480.49
17	19 15	44.211	152.617	17 48	21.42	171.64	17	21 16	02.772	146.897	13 15	23.28	485.70
18	19 18	16.803	152.592	17 45	22.32	179.10	18	21 18	29.476	146.704	13 07	12.42	490.86
19	19 20	49.366	152.563	17 42	15.77	186.55	19	21 20	55.985	146.509	12 58	56.49	495.93
20	19 23	21.896	152.530	17 39	01.81	193.96	20	21 23	22.299	146.314	12 50	35.56	500.93
21	19 25	54.387	152.491	17 35	40.44	201.37	21	21 25	48.414	146.115	12 42	09.69	505.87
22	19 28	26.835	152.448	17 32	11.70	208.74	22	21 28	14.331	145.917	12 33	38.97	510.72
23	19 30	59.235	152.400	-17 28	35.61	216.09	23	21 30	40.046	145.715	-12 25	03.46	515.51
		152.348				+ 223.42				145.513			+ 520.22
September 2							September 4						
0	19 33	31.583		-17 24	52.19	+ 230.71	0	21 33	05.559	145.310	-12 16	23.24	+ 524.85
1	19 36	03.874	152.291	17 21	01.48	237.99	1	21 35	30.869	145.106	12 07	38.39	529.41
2	19 38	36.104	152.230	17 17	03.49	245.22	2	21 37	55.975	145.106	11 58	48.98	529.41
3	19 41	08.267	152.163	17 12	58.27	252.42	3	21 40	20.875	144.900	11 49	55.09	533.89
4	19 43	40.361	152.094	17 08	45.85	259.60	4	21 42	45.568	144.693	11 40	56.79	538.30
5	19 46	12.379	152.018	17 04	26.25	266.74	5	21 45	10.053	144.485	11 31	54.16	542.63
6	19 48	44.318	151.939	16 59	59.51	273.84	6	21 47	34.330	144.277	11 22	47.28	546.88
7	19 51	16.174	151.856	16 55	25.67	280.90	7	21 49	58.398	144.068	11 13	36.22	551.06
8	19 53	47.942	151.768	16 50	44.77	287.94	8	21 52	22.255	143.857	11 04	21.07	555.15
9	19 56	19.618	151.676	16 45	56.83	294.92	9	21 54	45.902	143.647	10 55	01.89	559.18
10	19 58	51.197	151.579	16 41	01.91	301.86	10	21 57	09.338	143.436	10 45	38.78	563.11
11	20 01	22.677	151.480	16 36	00.05	308.78	11	21 59	32.561	143.223	10 36	11.80	566.98
12	20 03	54.052	151.375	16 30	51.27	315.63	12	22 01	55.573	143.012	10 26	41.05	570.75
13	20 06	25.319	151.267	16 25	35.64	322.46	13	22 04	18.371	142.798	10 17	06.58	574.47
14	20 08	56.473	151.154	16 20	13.18	329.22	14	22 06	40.957	142.586	10 07	28.50	578.08
15	20 11	27.512	151.039	16 14	43.96	335.95	15	22 09	03.330	142.373	9 57	46.87	581.63
16	20 13	58.431	150.919	16 09	08.01	342.62	16	22 11	25.489	142.159	9 48	01.77	585.10
17	20 16	29.226	150.795	16 03	25.39	349.25	17	22 13	47.434	141.945	9 38	13.29	588.48
18	20 18	59.894	150.668	15 57	36.14	355.83	18	22 16	09.166	141.732	9 28	21.50	591.79
19	20 21	30.430	150.536	15 51	40.31	362.36	19	22 18	30.685	141.519	9 18	26.49	595.01
20	20 24	00.833	150.403	15 45	37.95	368.83	20	22 20	51.990	141.305	9 08	28.33	598.16
21	20 26	31.098	150.265	15 39	29.12	375.24	21	22 23	13.082	141.092	8 58	27.11	601.22
22	20 29	01.221	150.123	15 33	13.88	381.61	22	22 25	33.961	140.879	8 48	22.91	604.20
23	20 31	31.200	149.979	15 26	52.27	+ 387.92	23	22 27	54.627	140.666	8 38	15.79	607.12
24	20 34	01.031	149.831	-15 20	24.35		24	22 30	15.080	140.453	- 8 28	05.86	+ 609.93

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 5			September 7		
h	h m s	° ' "	h	h m s	° ' "
0	22 30 15.080	- 8 28 05.86	0	0 18 45.194	+ 0 09 41.08
1	22 32 35.321	8 17 53.18	1	0 20 56.561	0 20 35.31
2	22 34 55.351	8 07 37.84	2	0 23 07.783	0 31 28.67
3	22 37 15.170	7 57 19.91	3	0 25 18.862	0 42 21.11
4	22 39 34.778	7 46 59.49	4	0 27 29.799	0 53 12.57
5	22 41 54.176	7 36 36.63	5	0 29 40.596	1 04 02.97
6	22 44 13.364	7 26 11.44	6	0 31 51.255	1 14 52.27
7	22 46 32.344	7 15 43.98	7	0 34 01.778	1 25 40.40
8	22 48 51.116	7 05 14.33	8	0 36 12.168	1 36 27.29
9	22 51 09.681	6 54 42.59	9	0 38 22.425	1 47 12.90
10	22 53 28.040	6 44 08.81	10	0 40 32.552	1 57 57.17
11	22 55 46.193	6 33 33.09	11	0 42 42.551	2 08 40.02
12	22 58 04.143	6 22 55.51	12	0 44 52.424	2 19 21.42
13	23 00 21.888	6 12 16.13	13	0 47 02.172	2 30 01.29
14	23 02 39.432	6 01 35.04	14	0 49 11.797	2 40 39.59
15	23 04 56.774	5 50 52.33	15	0 51 21.303	2 51 16.25
16	23 07 13.916	5 40 08.05	16	0 53 30.689	3 01 51.23
17	23 09 30.859	5 29 22.30	17	0 55 39.959	3 12 24.47
18	23 11 47.604	5 18 35.16	18	0 57 49.114	3 22 55.90
19	23 14 04.152	5 07 46.69	19	0 59 58.156	3 33 25.49
20	23 16 20.506	4 56 56.97	20	1 02 07.088	3 43 53.18
21	23 18 36.665	4 46 06.09	21	1 04 15.910	3 54 18.91
22	23 20 52.632	4 35 14.11	22	1 06 24.625	4 04 42.63
23	23 23 08.407	- 4 24 21.12	23	1 08 33.234	+ 4 15 04.30
	135.585	+653.94		128.506	+619.55
September 6			September 8		
0	23 25 23.992	- 4 13 27.18	0	1 10 41.740	+ 4 25 23.85
1	23 27 39.389	4 02 32.38	1	1 12 50.145	4 35 41.24
2	23 29 54.600	3 51 36.78	2	1 14 58.450	4 45 56.43
3	23 32 09.624	3 40 40.47	3	1 17 06.657	4 56 09.35
4	23 34 24.465	3 29 43.52	4	1 19 14.768	5 06 19.97
5	23 36 39.123	3 18 45.99	5	1 21 22.785	5 16 28.23
6	23 38 53.601	3 07 47.97	6	1 23 30.710	5 26 34.09
7	23 41 07.899	2 56 49.52	7	1 25 38.544	5 36 37.50
8	23 43 22.019	2 45 50.72	8	1 27 46.289	5 46 38.42
9	23 45 35.964	2 34 51.63	9	1 29 53.947	5 56 36.79
10	23 47 49.734	2 23 52.34	10	1 32 01.521	6 06 32.57
11	23 50 03.332	2 12 52.91	11	1 34 09.011	6 16 25.72
12	23 52 16.759	2 01 53.41	12	1 36 16.419	6 26 16.19
13	23 54 30.016	1 50 53.91	13	1 38 23.748	6 36 03.95
14	23 56 43.107	1 39 54.48	14	1 40 30.998	6 45 48.93
15	23 58 56.031	1 28 55.19	15	1 42 38.173	6 55 31.12
16	0 01 08.792	1 17 56.10	16	1 44 45.272	7 05 10.45
17	0 03 21.390	1 06 57.29	17	1 46 52.298	7 14 46.90
18	0 05 33.828	0 55 58.83	18	1 48 59.254	7 24 20.41
19	0 07 46.108	0 45 00.77	19	1 51 06.139	7 33 50.95
20	0 09 58.231	0 34 03.19	20	1 53 12.957	7 43 18.48
21	0 12 10.199	0 23 06.15	21	1 55 19.708	7 52 42.95
22	0 14 22.015	0 12 09.71	22	1 57 26.395	8 02 04.34
23	0 16 33.679	- 0 01 13.95	23	1 59 33.018	8 11 22.59
24	0 18 45.194	+ 0 09 41.08	24	2 01 39.580	+ 8 20 37.68
	131.515	+655.03		126.562	+555.09

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination				
September 9							September 11								
h	h	m	s	°	'	"	h	h	m	s	°	'	"		
0	2 01	39	580 ^s	+	8 20	37.68	0	3 42	08	555 ^s	+	14 32	04.15		
1	2 03	46	082	126.502	8 29	49.57	1	3 44	13	642	125.087	14 38	06.66	+362.51	
2	2 05	52	525	126.443	8 38	58.21	2	3 46	18	722	125.080	14 44	04.66	358.00	
3	2 07	58	912	126.387	8 48	03.57	3	3 48	23	795	125.073	14 49	58.11	353.45	
4	2 10	05	243	126.331	8 57	05.62	4	3 50	28	862	125.067	14 55	47.00	348.89	
5	2 12	11	521	126.278	9 06	04.31	5	3 52	33	922	125.060	15 01	31.32	344.32	
6	2 14	17	746	126.225	9 14	59.62	6	3 54	38	976	125.054	15 07	11.05	339.73	
7	2 16	23	920	126.174	9 23	51.51	7	3 56	44	026	125.050	15 12	46.17	335.12	
8	2 18	30	044	126.124	9 32	39.95	8	3 58	49	070	125.044	15 18	16.67	330.50	
9	2 20	36	121	126.077	9 41	24.89	9	4 00	54	110	125.040	15 23	42.53	325.86	
10	2 22	42	151	126.030	9 50	06.31	10	4 02	59	146	125.036	15 29	03.74	321.21	
11	2 24	48	135	125.984	9 58	44.18	11	4 05	04	178	125.032	15 34	20.27	316.53	
12	2 26	54	076	125.941	10 07	18.46	12	4 07	09	207	125.029	15 39	32.12	311.85	
13	2 28	59	974	125.898	10 15	49.12	13	4 09	14	233	125.026	15 44	39.27	307.15	
14	2 31	05	831	125.857	10 24	16.13	14	4 11	19	256	125.023	15 49	41.71	302.44	
15	2 33	11	648	125.817	10 32	39.46	15	4 13	24	277	125.021	15 54	39.42	297.71	
16	2 35	17	427	125.779	10 40	59.08	16	4 15	29	295	125.018	15 59	32.39	292.97	
17	2 37	23	168	125.741	10 49	14.95	17	4 17	34	311	125.016	16 04	20.61	288.22	
18	2 39	28	873	125.705	10 57	27.05	18	4 19	39	326	125.015	16 09	04.06	283.45	
19	2 41	34	543	125.670	11 05	35.34	19	4 21	44	338	125.012	16 13	42.72	278.66	
20	2 43	40	180	125.637	11 13	39.81	20	4 23	49	350	125.012	16 18	16.60	273.88	
21	2 45	45	784	125.604	11 21	40.41	21	4 25	54	359	125.009	16 22	45.67	269.07	
22	2 47	51	357	125.573	11 29	37.13	22	4 27	59	368	125.009	16 27	09.92	264.25	
23	2 49	56	899	125.542	+	11 37	29.93	23	4 30	04	375	125.007	+	16 31	29.35
			125.514			+468.86								+254.58	
September 10							September 12								
0	2 52	02	413	125.485	+	11 45	18.79	0	4 32	09	382	125.005	+	16 35	43.93
1	2 54	07	898	125.459	11 53	03.68	1	4 34	14	387	125.005	16 39	53.67	+249.74	
2	2 56	13	357	125.433	12 00	44.57	2	4 36	19	392	125.005	16 43	58.54	244.87	
3	2 58	18	790	125.408	12 08	21.44	3	4 38	24	396	125.004	16 47	58.54	240.00	
4	3 00	24	198	125.384	12 15	54.26	4	4 40	29	398	125.002	16 47	58.54	235.11	
5	3 02	29	582	125.362	12 23	23.00	5	4 42	34	400	125.002	16 51	53.65	230.23	
6	3 04	34	944	125.339	12 30	47.65	6	4 44	39	401	125.001	16 55	43.88	225.32	
7	3 06	40	283	125.319	12 38	08.17	7	4 46	44	401	125.000	16 59	29.20	220.41	
8	3 08	45	602	125.299	12 45	24.55	8	4 48	49	400	124.999	17 03	09.61	215.48	
9	3 10	50	901	125.280	12 52	36.75	9	4 50	54	397	124.997	17 06	45.09	210.56	
10	3 12	56	181	125.262	12 59	44.76	10	4 52	59	394	124.997	17 10	15.65	205.62	
11	3 15	01	443	125.244	13 06	48.55	11	4 55	04	389	124.995	17 13	41.27	200.67	
12	3 17	06	687	125.228	13 13	48.11	12	4 57	09	383	124.994	17 17	01.94	195.72	
13	3 19	11	915	125.213	13 20	43.39	13	4 59	14	375	124.992	17 20	17.66	190.75	
14	3 21	17	128	125.197	13 27	34.40	14	5 01	19	365	124.990	17 23	28.41	185.78	
15	3 23	22	325	125.184	13 34	21.09	15	5 03	24	353	124.988	17 26	34.19	180.80	
16	3 25	27	509	125.170	13 41	03.46	16	5 05	29	340	124.987	17 29	34.99	175.82	
17	3 27	32	679	125.158	13 47	41.48	17	5 07	34	323	124.983	17 32	30.81	170.82	
18	3 29	37	837	125.145	13 54	15.13	18	5 09	39	305	124.982	17 35	21.63	165.83	
19	3 31	42	982	125.135	14 00	44.39	19	5 11	44	283	124.978	17 38	07.46	160.82	
20	3 33	48	117	125.123	14 07	09.24	20	5 13	49	258	124.975	17 40	48.28	155.81	
21	3 35	53	240	125.114	14 13	29.66	21	5 15	54	230	124.972	17 43	24.09	150.79	
22	3 37	58	354	125.105	14 19	45.63	22	5 17	59	199	124.969	17 45	54.88	145.77	
23	3 40	03	459	125.096	14 25	57.13	23	5 20	04	163	124.964	17 48	20.65	140.74	
24	3 42	08	555		+	14 32	04.15	24	5 22	09	123	124.960	+	17 50	41.39
						+367.02								+135.71	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 13			September 15		
h	h m s	° ' "	h	h m s	° ' "
0	5 22 09.123 ^s 124.956	+17 52 57.10 ["] +130.67	0	7 01 54.067 ^s 124.216	+18 02 16.26 ["] -111.85
1	5 24 14.079 ^s 124.951	17 55 07.77 ["] 125.63	1	7 03 58.283 ^s 124.188	18 00 24.41 ["] 116.82
2	5 26 19.030 ^s 124.946	17 57 13.40 ["] 120.58	2	7 06 02.471 ^s 124.161	17 58 27.59 ["] 121.77
3	5 28 23.976 ^s 124.940	17 59 13.98 ["] 115.53	3	7 08 06.632 ^s 124.133	17 56 25.82 ["] 126.72
4	5 30 28.916 ^s 124.934	18 01 09.51 ["] 110.48	4	7 10 10.765 ^s 124.104	17 54 19.10 ["] 131.66
5	5 32 33.850 ^s 124.928	18 02 59.99 ["] 105.42	5	7 12 14.869 ^s 124.075	17 52 07.44 ["] 136.59
6	5 34 38.778 ^s 124.921	18 04 45.41 ["] 100.36	6	7 14 18.944 ^s 124.046	17 49 50.85 ["] 141.52
7	5 36 43.699 ^s 124.915	18 06 25.77 ["] 95.29	7	7 16 22.990 ^s 124.015	17 47 29.33 ["] 146.43
8	5 38 48.614 ^s 124.907	18 08 01.06 ["] 90.22	8	7 18 27.005 ^s 123.986	17 45 02.90 ["] 151.33
9	5 40 53.521 ^s 124.898	18 09 31.28 ["] 85.16	9	7 20 30.991 ^s 123.955	17 42 31.57 ["] 156.23
10	5 42 58.419 ^s 124.891	18 10 56.44 ["] 80.08	10	7 22 34.946 ^s 123.923	17 39 55.34 ["] 161.11
11	5 45 03.310 ^s 124.882	18 12 16.52 ["] 75.01	11	7 24 38.869 ^s 123.892	17 37 14.23 ["] 165.99
12	5 47 08.192 ^s 124.873	18 13 31.53 ["] 69.94	12	7 26 42.761 ^s 123.861	17 34 28.24 ["] 170.84
13	5 49 13.065 ^s 124.863	18 14 41.47 ["] 64.86	13	7 28 46.622 ^s 123.828	17 31 37.40 ["] 175.71
14	5 51 17.928 ^s 124.853	18 15 46.33 ["] 59.77	14	7 30 50.450 ^s 123.796	17 28 41.69 ["] 180.54
15	5 53 22.781 ^s 124.842	18 16 46.10 ["] 54.70	15	7 32 54.246 ^s 123.763	17 25 41.15 ["] 185.38
16	5 55 27.623 ^s 124.832	18 17 40.80 ["] 49.62	16	7 34 58.009 ^s 123.730	17 22 35.77 ["] 190.20
17	5 57 32.455 ^s 124.820	18 18 30.42 ["] 44.54	17	7 37 01.739 ^s 123.697	17 19 25.57 ["] 195.00
18	5 59 37.275 ^s 124.808	18 19 14.96 ["] 39.46	18	7 39 05.436 ^s 123.663	17 16 10.57 ["] 199.80
19	6 01 42.083 ^s 124.795	18 19 54.42 ["] 34.37	19	7 41 09.099 ^s 123.630	17 12 50.77 ["] 204.58
20	6 03 46.878 ^s 124.783	18 20 28.79 ["] 29.30	20	7 43 12.729 ^s 123.595	17 09 26.19 ["] 209.36
21	6 05 51.661 ^s 124.770	18 20 58.09 ["] 24.21	21	7 45 16.324 ^s 123.561	17 05 56.83 ["] 214.11
22	6 07 56.431 ^s 124.755	18 21 22.30 ["] 19.14	22	7 47 19.885 ^s 123.526	17 02 22.72 ["] 218.86
23	6 10 01.186 ^s 124.741	+18 21 41.44 ["] +14.05	23	7 49 23.411 ^s 123.491	+16 58 43.86 ["] -223.59
September 14			September 16		
0	6 12 05.927 ^s 124.726	+18 21 55.49 ["] +8.98	0	7 51 26.902 ^s 123.457	+16 55 00.27 ["] -228.31
1	6 14 10.653 ^s 124.711	18 22 04.47 ["] +3.91	1	7 53 30.359 ^s 123.421	16 51 11.96 ["] 233.02
2	6 16 15.364 ^s 124.695	18 22 08.38 ["] -1.17	2	7 55 33.780 ^s 123.386	16 47 18.94 ["] 237.70
3	6 18 20.059 ^s 124.678	18 22 07.21 ["] -6.25	3	7 57 37.166 ^s 123.350	16 43 21.24 ["] 242.38
4	6 20 24.737 ^s 124.662	18 22 00.96 ["] -11.31	4	7 59 40.516 ^s 123.315	16 39 18.86 ["] 247.04
5	6 22 29.399 ^s 124.644	18 21 49.65 ["] -16.38	5	8 01 43.831 ^s 123.279	16 35 11.82 ["] 251.69
6	6 24 34.043 ^s 124.626	18 21 33.27 ["] -21.45	6	8 03 47.110 ^s 123.243	16 31 00.13 ["] 256.32
7	6 26 38.669 ^s 124.607	18 21 11.82 ["] -26.50	7	8 05 50.353 ^s 123.207	16 26 43.81 ["] 260.94
8	6 28 43.276 ^s 124.589	18 20 45.32 ["] -31.57	8	8 07 53.560 ^s 123.172	16 22 22.87 ["] 265.53
9	6 30 47.865 ^s 124.569	18 20 13.75 ["] -36.62	9	8 09 56.732 ^s 123.135	16 17 57.34 ["] 270.12
10	6 32 52.434 ^s 124.548	18 19 37.13 ["] -41.67	10	8 11 59.867 ^s 123.099	16 13 27.22 ["] 274.69
11	6 34 56.982 ^s 124.529	18 18 55.46 ["] -46.72	11	8 14 02.966 ^s 123.063	16 08 52.53 ["] 279.24
12	6 37 01.511 ^s 124.507	18 18 08.74 ["] -51.76	12	8 16 06.029 ^s 123.026	16 04 13.29 ["] 283.77
13	6 39 06.018 ^s 124.486	18 17 16.98 ["] -56.80	13	8 18 09.055 ^s 122.991	15 59 29.52 ["] 288.29
14	6 41 10.504 ^s 124.464	18 16 20.18 ["] -61.83	14	8 20 12.046 ^s 122.955	15 54 41.23 ["] 292.79
15	6 43 14.968 ^s 124.441	18 15 18.35 ["] -66.86	15	8 22 15.001 ^s 122.918	15 49 48.44 ["] 297.27
16	6 45 19.409 ^s 124.418	18 14 11.49 ["] -71.88	16	8 24 17.919 ^s 122.883	15 44 51.17 ["] 301.74
17	6 47 23.827 ^s 124.394	18 12 59.61 ["] -76.91	17	8 26 20.802 ^s 122.847	15 39 49.43 ["] 306.18
18	6 49 28.221 ^s 124.371	18 11 42.70 ["] -81.91	18	8 28 23.649 ^s 122.811	15 34 43.25 ["] 310.61
19	6 51 32.592 ^s 124.346	18 10 20.79 ["] -86.92	19	8 30 26.460 ^s 122.776	15 29 32.64 ["] 315.02
20	6 53 36.938 ^s 124.321	18 08 53.87 ["] -91.92	20	8 32 29.236 ^s 122.740	15 24 17.62 ["] 319.40
21	6 55 41.259 ^s 124.295	18 07 21.95 ["] -96.91	21	8 34 31.976 ^s 122.704	15 18 58.22 ["] 323.78
22	6 57 45.554 ^s 124.270	18 05 45.04 ["] -101.90	22	8 36 34.680 ^s 122.670	15 13 34.44 ["] 328.13
23	6 59 49.824 ^s 124.243	18 04 03.14 ["] -106.88	23	8 38 37.350 ^s 122.635	15 08 06.31 ["] -332.46
24	7 01 54.067 ^s	+18 02 16.26 ["]	24	8 40 39.985 ^s	+15 02 33.85 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 17			September 19		
h	h m s	° ' "	h	h m s	° ' "
0	8 40 39.985 122.600	+15 02 33.85 -336.77	0	10 18 14.533 121.602	+9 19 22.88 -514.39
1	8 42 42.585 122.565	14 56 57.08 341.07	1	10 20 16.135 121.605	9 10 48.49 517.35
2	8 44 45.150 122.532	14 51 16.01 345.33	2	10 22 17.740 121.607	9 02 11.14 520.29
3	8 46 47.682 122.498	14 45 30.68 349.58	3	10 24 19.347 121.611	8 53 30.85 523.19
4	8 48 50.180 122.464	14 39 41.10 353.81	4	10 26 20.958 121.617	8 44 47.66 526.06
5	8 50 52.644 122.430	14 33 47.29 358.01	5	10 28 22.575 121.623	8 36 01.60 528.88
6	8 52 55.074 122.398	14 27 49.28 362.20	6	10 30 24.198 121.631	8 27 12.72 531.67
7	8 54 57.472 122.366	14 21 47.08 366.36	7	10 32 25.829 121.641	8 18 21.05 534.43
8	8 56 59.838 122.333	14 15 40.72 370.50	8	10 34 27.470 121.651	8 09 26.62 537.14
9	8 59 02.171 122.301	14 09 30.22 374.62	9	10 36 29.121 121.663	8 00 29.48 539.83
10	9 01 04.472 122.270	14 03 15.60 378.71	10	10 38 30.784 121.677	7 51 29.65 542.47
11	9 03 06.742 122.240	13 56 56.89 382.78	11	10 40 32.461 121.692	7 42 27.18 545.08
12	9 05 08.982 122.209	13 50 34.11 386.83	12	10 42 34.153 121.708	7 33 22.10 547.65
13	9 07 11.191 122.179	13 44 07.28 390.85	13	10 44 35.861 121.726	7 24 14.45 550.18
14	9 09 13.370 122.149	13 37 36.43 394.86	14	10 46 37.587 121.745	7 15 04.27 552.67
15	9 11 15.519 122.121	13 31 01.57 398.82	15	10 48 39.332 121.765	7 05 51.60 555.12
16	9 13 17.640 122.092	13 24 22.75 402.78	16	10 50 41.097 121.788	6 56 36.48 557.54
17	9 15 19.732 122.065	13 17 39.97 406.70	17	10 52 42.885 121.812	6 47 18.94 559.91
18	9 17 21.797 122.037	13 10 53.27 410.61	18	10 54 44.697 121.837	6 37 59.03 562.25
19	9 19 23.834 122.011	13 04 02.66 414.47	19	10 56 46.534 121.863	6 28 36.78 564.54
20	9 21 25.845 121.985	12 57 08.19 418.33	20	10 58 48.397 121.892	6 19 12.24 566.79
21	9 23 27.830 121.960	12 50 09.86 422.15	21	11 00 50.289 121.922	6 09 45.45 569.01
22	9 25 29.790 121.935	12 43 07.71 425.94	22	11 02 52.211 121.953	6 00 16.44 571.18
23	9 27 31.725 121.912	+12 36 01.77 -429.71	23	11 04 54.164 121.987	+5 50 45.26 -573.31
September 18			September 20		
0	9 29 33.637 121.888	+12 28 52.06 -433.46	0	11 06 56.151 122.021	+5 41 11.95 -575.40
1	9 31 35.525 121.866	12 21 38.60 437.17	1	11 08 58.172 122.058	5 31 36.55 577.45
2	9 33 37.391 121.844	12 14 21.43 440.86	2	11 11 00.230 122.095	5 21 59.10 579.45
3	9 35 39.235 121.823	12 07 00.57 444.51	3	11 13 02.325 122.136	5 12 19.65 581.41
4	9 37 41.058 121.803	11 59 36.06 448.15	4	11 15 04.461 122.176	5 02 38.24 583.33
5	9 39 42.861 121.784	11 52 07.91 451.75	5	11 17 06.637 122.220	4 52 54.91 585.21
6	9 41 44.645 121.766	11 44 36.16 455.33	6	11 19 08.857 122.265	4 43 09.70 587.04
7	9 43 46.411 121.748	11 37 00.83 458.87	7	11 21 11.122 122.311	4 33 22.66 588.83
8	9 45 48.159 121.732	11 29 21.96 462.38	8	11 23 13.433 122.359	4 23 33.83 590.57
9	9 47 49.891 121.715	11 21 39.58 465.87	9	11 25 15.792 122.409	4 13 43.26 592.28
10	9 49 51.606 121.701	11 13 53.71 469.33	10	11 27 18.201 122.461	4 03 50.98 593.92
11	9 51 53.307 121.687	11 06 04.38 472.75	11	11 29 20.662 122.514	3 53 57.06 595.54
12	9 53 54.994 121.674	10 58 11.63 476.14	12	11 31 23.176 122.570	3 44 01.52 597.10
13	9 55 56.668 121.663	10 50 15.49 479.51	13	11 33 25.746 122.627	3 34 04.42 598.63
14	9 57 58.331 121.651	10 42 15.98 482.85	14	11 35 28.373 122.685	3 24 05.79 600.09
15	9 59 59.982 121.642	10 34 13.13 486.14	15	11 37 31.058 122.746	3 14 05.70 601.52
16	10 02 01.624 121.633	10 26 06.99 489.41	16	11 39 33.804 122.809	3 04 04.18 602.90
17	10 04 03.257 121.625	10 17 57.58 492.65	17	11 41 36.613 122.873	2 54 01.28 604.24
18	10 06 04.882 121.618	10 09 44.93 495.86	18	11 43 39.486 122.939	2 43 57.04 605.52
19	10 08 06.500 121.613	10 01 29.07 499.03	19	11 45 42.425 123.007	2 33 51.52 606.75
20	10 10 08.113 121.609	9 53 10.04 502.16	20	11 47 45.432 123.077	2 23 44.77 607.95
21	10 12 09.722 121.605	9 44 47.88 505.28	21	11 49 48.509 123.148	2 13 36.82 609.09
22	10 14 11.327 121.603	9 36 22.60 508.34	22	11 51 51.657 123.223	2 03 27.73 610.19
23	10 16 12.930 121.603	9 27 54.26 511.38	23	11 53 54.880 123.297	1 53 17.54 611.23
24	10 18 14.533	+9 19 22.88	24	11 55 58.177	+1 43 06.31

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 21			September 23		
h	h m s	° ' "	h	h m s	° ' "
0	11 55 58.177	123.375	0	13 36 42.908	129.341
1	11 58 01.552	123.455	1	13 38 52.249	129.509
2	12 00 05.007	123.535	2	13 41 01.758	129.681
3	12 02 08.542	123.619	3	13 43 11.439	129.852
4	12 04 12.161	123.703	4	13 45 21.291	130.027
5	12 06 15.864	123.791	5	13 47 31.318	130.202
6	12 08 19.655	123.879	6	13 49 41.520	130.379
7	12 10 23.534	123.970	7	13 51 51.899	130.557
8	12 12 27.504	124.063	8	13 54 02.456	130.737
9	12 14 31.567	124.158	9	13 56 13.193	130.918
10	12 16 35.725	124.254	10	13 58 24.111	131.101
11	12 18 39.979	124.352	11	14 00 35.212	131.285
12	12 20 44.331	124.453	12	14 02 46.497	131.470
13	12 22 48.784	124.555	13	14 04 57.967	131.657
14	12 24 53.339	124.660	14	14 07 09.624	131.845
15	12 26 57.999	124.766	15	14 09 21.469	132.035
16	12 29 02.765	124.874	16	14 11 33.504	132.225
17	12 31 07.639	124.984	17	14 13 45.729	132.417
18	12 33 12.623	125.097	18	14 15 58.146	132.609
19	12 35 17.720	125.211	19	14 18 10.755	132.804
20	12 37 22.931	125.326	20	14 20 23.559	132.999
21	12 39 28.257	125.445	21	14 22 36.558	133.194
22	12 41 33.702	125.565	22	14 24 49.752	133.392
23	12 43 39.267	125.686	23	14 27 03.144	133.591
September 22			September 24		
0	12 45 44.953	125.810	0	14 29 16.735	133.789
1	12 47 50.763	125.936	1	14 31 30.524	133.989
2	12 49 56.699	126.064	2	14 33 44.513	134.190
3	12 52 02.763	126.193	3	14 35 58.703	134.391
4	12 54 08.956	126.325	4	14 38 13.094	134.594
5	12 56 15.281	126.458	5	14 40 27.688	134.797
6	12 58 21.739	126.593	6	14 42 42.485	135.001
7	13 00 28.332	126.731	7	14 44 57.486	135.205
8	13 02 35.063	126.870	8	14 47 12.691	135.411
9	13 04 41.933	127.010	9	14 49 28.102	135.615
10	13 06 48.943	127.153	10	14 51 43.717	135.822
11	13 08 56.096	127.298	11	14 53 59.539	136.029
12	13 11 03.394	127.445	12	14 56 15.568	136.235
13	13 13 10.839	127.593	13	14 58 31.803	136.442
14	13 15 18.432	127.742	14	15 00 48.245	136.650
15	13 17 26.174	127.895	15	15 03 04.895	136.858
16	13 19 34.069	128.049	16	15 05 21.753	137.066
17	13 21 42.118	128.204	17	15 07 38.819	137.274
18	13 23 50.322	128.361	18	15 09 56.093	137.482
19	13 25 58.683	128.520	19	15 12 13.575	137.690
20	13 28 07.203	128.681	20	15 14 31.265	137.899
21	13 30 15.884	128.843	21	15 16 49.164	138.106
22	13 32 24.727	129.008	22	15 19 07.270	138.315
23	13 34 33.735	129.173	23	15 21 25.585	138.522
24	13 36 42.908		24	15 23 44.107	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension		Apparent Declination		Hour	Apparent Right Ascension		Apparent Declination	
September 25					September 27				
h	m	s	°	'	h	m	s	°	'
0	15	23	44.107	138° 73' 0"	0	17	18	18.189	175° 50' 32.86"
1	15	26	02.837	138° 937'	1	17	20	45.355	175° 53' 17.41"
2	15	28	21.774	139° 144'	2	17	23	12.640	175° 55' 55.11"
3	15	30	40.918	139° 350'	3	17	25	40.040	175° 58' 25.92"
4	15	33	00.268	139° 556'	4	17	28	07.553	176° 00' 49.81"
5	15	35	19.824	139° 761'	5	17	30	35.174	176° 03' 06.76"
6	15	37	39.585	139° 966'	6	17	33	02.900	176° 05' 16.74"
7	15	39	59.551	140° 171'	7	17	35	30.728	176° 07' 19.73"
8	15	42	19.722	140° 373'	8	17	37	58.655	176° 09' 15.70"
9	15	44	40.095	140° 576'	9	17	40	26.676	176° 11' 04.64"
10	15	47	00.671	140° 778'	10	17	42	54.789	176° 12' 46.51"
11	15	49	21.449	140° 978'	11	17	45	22.989	176° 14' 21.31"
12	15	51	42.427	141° 178'	12	17	47	51.274	176° 15' 49.00"
13	15	54	03.605	141° 377'	13	17	50	19.638	176° 17' 09.58"
14	15	56	24.982	141° 574'	14	17	52	48.080	176° 18' 23.02"
15	15	58	46.556	141° 771'	15	17	55	16.594	176° 19' 29.31"
16	16	01	08.327	141° 965'	16	17	57	45.178	176° 20' 28.44"
17	16	03	30.292	142° 160'	17	18	00	13.827	176° 21' 20.38"
18	16	05	52.452	142° 352'	18	18	02	42.537	176° 22' 05.13"
19	16	08	14.804	142° 542'	19	18	05	11.306	176° 22' 42.68"
20	16	10	37.346	142° 733'	20	18	07	40.128	176° 23' 13.00"
21	16	13	00.079	142° 920'	21	18	10	09.001	176° 23' 36.10"
22	16	15	22.999	143° 106'	22	18	12	37.919	176° 23' 51.96"
23	16	17	46.105	143° 291'	23	18	15	06.881	176° 24' 00.59"
September 26					September 28				
0	16	20	09.396	161° 11' 53.99"	0	18	17	35.880	176° 24' 01.96"
1	16	22	32.870	161° 17' 12.50"	1	18	20	04.914	176° 23' 56.07"
2	16	24	56.524	162° 22' 25.08"	2	18	22	33.979	176° 23' 42.92"
3	16	27	20.358	162° 27' 31.67"	3	18	25	03.070	176° 23' 22.52"
4	16	29	44.368	162° 32' 32.25"	4	18	27	32.185	176° 22' 54.84"
5	16	32	08.554	162° 37' 26.75"	5	18	30	01.318	176° 22' 19.90"
6	16	34	32.913	162° 42' 15.13"	6	18	32	30.466	176° 21' 37.69"
7	16	36	57.442	162° 46' 57.36"	7	18	34	59.625	176° 20' 48.22"
8	16	39	22.140	162° 51' 33.37"	8	18	37	28.791	176° 19' 51.48"
9	16	41	47.004	162° 56' 03.14"	9	18	39	57.960	176° 18' 47.49"
10	16	44	12.033	163° 00' 26.62"	10	18	42	27.128	176° 17' 36.23"
11	16	46	37.222	163° 04' 43.76"	11	18	44	56.292	176° 16' 17.73"
12	16	49	02.571	163° 08' 54.54"	12	18	47	25.447	176° 14' 51.99"
13	16	51	28.077	163° 12' 58.89"	13	18	49	54.589	176° 13' 19.01"
14	16	53	53.736	163° 16' 56.80"	14	18	52	23.715	176° 11' 38.80"
15	16	56	19.547	163° 20' 48.21"	15	18	54	52.821	176° 09' 51.38"
16	16	58	45.506	163° 24' 33.10"	16	18	57	21.903	176° 07' 56.75"
17	17	01	11.611	163° 28' 11.42"	17	18	59	50.957	176° 05' 54.93"
18	17	03	37.859	163° 31' 43.13"	18	19	02	19.979	176° 03' 45.93"
19	17	06	04.248	163° 35' 08.21"	19	19	04	48.965	176° 01' 29.76"
20	17	08	30.774	163° 38' 26.61"	20	19	07	17.913	175° 59' 06.45"
21	17	10	57.433	163° 41' 38.31"	21	19	09	46.817	175° 56' 36.00"
22	17	13	24.225	163° 44' 43.28"	22	19	12	15.674	175° 53' 58.44"
23	17	15	51.144	163° 47' 47.47"	23	19	14	44.482	175° 51' 13.79"
24	17	18	18.189	163° 50' 32.86"	24	19	17	13.235	175° 48' 22.05"

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
September 29							October 1						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	19	17	13.235	148.696	-17	48 22.05	0	21	14	09.888	142.645	-13	22 58.29
1	19	19	41.931	148.634	17	45 23.27	1	21	16	32.533	142.475	13	15 04.51
2	19	22	10.565	148.570	17	42 17.45	2	21	18	55.008	142.303	13	07 05.82
3	19	24	39.135	148.501	17	39 04.62	3	21	21	17.311	142.132	12	59 02.29
4	19	27	07.636	148.430	17	35 44.81	4	21	23	39.443	141.958	12	50 53.99
5	19	29	36.066	148.355	17	32 18.03	5	21	26	01.401	141.786	12	42 40.97
6	19	32	04.421	148.276	17	28 44.32	6	21	28	23.187	141.612	12	34 23.30
7	19	34	32.697	148.195	17	25 03.71	7	21	30	44.799	141.437	12	26 01.04
8	19	37	00.892	148.109	17	21 16.22	8	21	33	06.236	141.263	12	17 34.25
9	19	39	29.001	148.021	17	17 21.88	9	21	35	27.499	141.088	12	09 03.01
10	19	41	57.022	147.930	17	13 20.72	10	21	37	48.587	140.912	12	00 27.37
11	19	44	24.952	147.835	17	09 12.77	11	21	40	09.499	140.737	11	51 47.40
12	19	46	52.787	147.737	17	04 58.07	12	21	42	30.236	140.562	11	43 03.16
13	19	49	20.524	147.637	17	00 36.65	13	21	44	50.798	140.385	11	34 14.73
14	19	51	48.161	147.532	16	56 08.55	14	21	47	11.183	140.210	11	25 22.16
15	19	54	15.693	147.426	16	51 33.79	15	21	49	31.393	140.034	11	16 25.52
16	19	56	43.119	147.317	16	46 52.42	16	21	51	51.427	139.858	11	07 24.89
17	19	59	10.436	147.204	16	42 04.46	17	21	54	11.285	139.682	10	58 20.32
18	20	01	37.640	147.088	16	37 09.97	18	21	56	30.967	139.507	10	49 11.89
19	20	04	04.728	146.971	16	32 08.98	19	21	58	50.474	139.331	10	39 59.66
20	20	06	31.699	146.850	16	27 01.53	20	22	01	09.805	139.156	10	30 43.70
21	20	08	58.549	146.727	16	21 47.66	21	22	03	28.961	138.981	10	21 24.08
22	20	11	25.276	146.602	16	16 27.41	22	22	05	47.942	138.807	10	12 00.87
23	20	13	51.878	146.473	-16	11 00.82	23	22	08	06.749	138.632	-10	02 34.14
						+332.87							+570.19
September 30							October 2						
0	20	16	18.351	146.342	-16	05 27.95	0	22	10	25.381	138.459	-9	53 03.95
1	20	18	44.693	146.209	15	59 48.82	1	22	12	43.840	138.286	9	43 30.37
2	20	21	10.902	146.075	15	54 03.50	2	22	15	02.126	138.113	9	33 53.47
3	20	23	36.977	145.936	15	48 12.02	3	22	17	20.239	137.941	9	24 13.33
4	20	26	02.913	145.797	15	42 14.42	4	22	19	38.180	137.770	9	14 30.01
5	20	28	28.710	145.655	15	36 10.77	5	22	21	55.950	137.599	9	04 43.58
6	20	30	54.365	145.512	15	30 01.10	6	22	24	13.549	137.428	8	54 54.12
7	20	33	19.877	145.365	15	23 45.47	7	22	26	30.977	137.260	8	45 01.68
8	20	35	45.242	145.218	15	17 23.92	8	22	28	48.237	137.091	8	35 06.35
9	20	38	10.460	145.068	15	10 56.51	9	22	31	05.328	136.923	8	25 08.19
10	20	40	35.528	144.917	15	04 23.29	10	22	33	22.251	136.756	8	15 07.27
11	20	43	00.445	144.763	14	57 44.31	11	22	35	39.007	136.591	8	05 03.66
12	20	45	25.208	144.609	14	50 59.62	12	22	37	55.598	136.425	7	54 57.44
13	20	47	49.817	144.452	14	44 09.28	13	22	40	12.023	136.261	7	44 48.67
14	20	50	14.269	144.295	14	37 13.33	14	22	42	28.284	136.099	7	34 37.43
15	20	52	38.564	144.135	14	30 11.85	15	22	44	44.383	135.936	7	24 23.78
16	20	55	02.699	143.975	14	23 04.87	16	22	47	00.319	135.776	7	14 07.79
17	20	57	26.674	143.812	14	15 52.46	17	22	49	16.095	135.615	7	03 49.55
18	20	59	50.486	143.649	14	08 34.67	18	22	51	31.710	135.457	6	53 29.10
19	21	02	14.135	143.484	14	01 11.56	19	22	53	47.167	135.300	6	43 06.54
20	21	04	37.619	143.318	13	53 43.20	20	22	56	02.467	135.143	6	32 41.92
21	21	07	00.937	143.152	13	46 09.62	21	22	58	17.610	134.988	6	22 15.32
22	21	09	24.089	142.984	13	38 30.91	22	23	00	32.598	134.835	6	11 46.81
23	21	11	47.073	142.815	13	30 47.11	23	23	02	47.433	134.681	6	01 16.45
24	21	14	09.888		-13	22 58.29	24	23	05	02.114		-5	50 44.33
						+468.82							+632.12

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
October 3									October 5								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	23	05	02.114	134.531	—	5	50	44.33	0	05	16.912	129.096	+	2	47	19.09	636.28
1	23	07	16.645	134.381		5	40	10.50	1	05	26.008	129.023		2	57	55.37	634.80
2	23	09	31.026	134.232		5	29	35.05	2	05	35.031	128.951		3	08	30.17	633.25
3	23	11	45.258	134.085		5	18	58.03	3	05	43.982	128.881		3	19	03.42	631.65
4	23	13	59.343	133.939		5	08	19.53	4	05	52.863	128.813		3	29	35.07	629.99
5	23	16	13.282	133.795		4	57	39.60	5	10	01.676	128.746		3	40	05.06	628.28
6	23	18	27.077	133.652		4	46	58.33	6	10	10.422	128.681		3	50	33.34	626.51
7	23	20	40.729	133.511		4	36	15.77	7	10	19.103	128.617		4	00	59.85	624.68
8	23	22	54.240	133.371		4	25	32.00	8	10	27.720	128.554		4	11	24.53	622.80
9	23	25	07.611	133.232		4	14	47.09	9	10	36.274	128.494		4	21	47.33	620.87
10	23	27	20.843	133.095		4	04	01.11	10	11	44.768	128.434		4	32	08.20	618.88
11	23	29	33.938	132.960		3	53	14.12	11	13	53.202	128.377		4	42	27.08	616.84
12	23	31	46.898	132.826		3	42	26.20	12	16	01.579	128.320		4	52	43.92	614.75
13	23	33	59.724	132.693		3	31	37.41	13	18	09.899	128.265		5	02	58.67	612.60
14	23	36	12.417	132.563		3	20	47.83	14	20	18.164	128.212		5	13	11.27	610.41
15	23	38	24.980	132.434		3	09	57.51	15	22	26.376	128.159		5	23	21.68	608.15
16	23	40	37.414	132.306		2	59	06.54	16	24	34.535	128.109		5	33	29.83	605.85
17	23	42	49.720	132.180		2	48	14.97	17	26	42.644	128.059		5	43	35.68	603.50
18	23	45	01.900	132.055		2	37	22.88	18	28	50.703	128.011		6	03	40.28	601.10
19	23	47	13.955	131.933		2	26	30.33	19	30	58.714	127.965		6	13	38.92	598.64
20	23	49	25.888	131.812		2	15	37.39	20	33	06.679	127.919		6	23	35.07	596.15
21	23	51	37.700	131.692		2	04	44.13	21	35	14.598	127.875		6	33	28.66	593.59
22	23	53	49.392	131.575	—	1	53	50.60	22	37	22.473	127.833	+	6	43	19.66	591.00
23	23	56	00.967	131.458		1	42	56.89	23	39	30.306	127.790		6	53	08.01	588.35
October 4									October 6								
0	23	58	12.425	131.344	—	1	32	03.06	0	14	38.096	127.751	+	6	53	08.01	585.65
1	00	00	23.769	131.230		1	21	09.16	1	43	45.847	127.712		7	02	53.66	582.91
2	00	02	34.999	131.120		1	10	15.28	2	45	53.559	127.673		7	12	36.57	580.13
3	00	04	46.119	131.010		0	59	21.46	3	48	01.232	127.637		7	22	16.70	577.29
4	00	06	57.129	130.902		0	48	27.79	4	50	08.869	127.602		7	31	53.99	574.41
5	00	09	08.031	130.796		0	37	34.32	5	52	16.471	127.567		7	41	28.40	571.48
6	00	11	18.827	130.692		0	26	41.11	6	54	24.038	127.535		8	00	28.40	568.52
7	00	13	29.519	130.589		0	15	48.24	7	56	31.573	127.502		8	09	53.90	565.50
8	00	15	40.108	130.487	—	0	04	55.77	8	58	39.075	127.471		8	19	16.34	562.44
9	00	17	50.595	130.389	+	0	55	56.25	9	00	46.546	127.441		8	28	35.67	559.33
10	00	20	00.984	130.290		0	44	47.74	10	02	53.987	127.412		8	37	51.87	556.20
11	00	22	11.274	130.194		0	33	38.65	11	05	01.399	127.385		8	47	04.87	553.00
12	00	24	21.468	130.100		0	22	28.91	12	07	08.784	127.358		8	56	14.65	549.78
13	00	26	31.568	130.008		0	11	18.46	13	09	16.142	127.332		9	05	21.16	546.51
14	00	28	41.576	129.916		1	00	07.23	14	11	23.474	127.306		9	14	24.35	543.19
15	00	30	51.492	129.826		1	10	55.17	15	13	30.780	127.283		9	23	24.19	539.84
16	00	33	01.318	129.740		1	21	42.22	16	15	38.063	127.260		9	32	20.64	536.45
17	00	35	11.058	129.652		1	32	28.30	17	17	45.323	127.238		9	41	13.65	533.01
18	00	37	20.710	129.569		1	43	13.37	18	19	52.561	127.217		9	50	03.19	529.54
19	00	39	30.279	129.486		1	53	57.37	19	21	59.778	127.196		9	58	49.23	526.04
20	00	41	39.765	129.404		2	04	40.22	20	24	06.974	127.176		10	07	31.71	522.48
21	00	43	49.169	129.325		2	15	21.88	21	26	14.150	127.158		10	16	10.61	518.90
22	00	45	58.494	129.247		2	26	02.28	22	28	21.308	127.139		10	24	45.88	515.27
23	00	48	07.741	129.171		2	36	41.37	23	30	28.447	127.122	+	10	33	17.49	511.61
24	00	50	16.912		+	2	47	19.09	24	32	35.569						

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
October 7									October 9								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	2	32	35.569	127.106	+10	33	17.49	+507.92	0	4	14	05.982	126.711	+16	00	44.25	+296.76
1	2	34	42.675	127.090	10	41	45.41	504.18	1	4	16	12.693	126.703	16	05	41.01	291.85
2	2	36	49.765	127.075	10	50	09.59	500.41	2	4	18	19.396	126.693	16	10	32.86	286.91
3	2	38	56.840	127.060	10	58	30.00	496.62	3	4	20	26.089	126.684	16	15	19.77	281.96
4	2	41	03.900	127.046	11	06	46.62	492.77	4	4	22	32.773	126.674	16	20	01.73	277.01
5	2	43	10.946	127.033	11	14	59.39	488.90	5	4	24	39.447	126.664	16	24	38.74	272.03
6	2	45	17.979	127.020	11	23	08.29	484.99	6	4	26	46.111	126.653	16	29	10.77	267.05
7	2	47	24.999	127.008	11	31	13.28	481.06	7	4	28	52.764	126.641	16	33	37.82	262.06
8	2	49	32.007	126.997	11	39	14.34	477.09	8	4	30	59.405	126.630	16	37	59.88	257.04
9	2	51	39.004	126.985	11	47	11.43	473.08	9	4	33	06.035	126.618	16	42	16.92	252.03
10	2	53	45.989	126.975	11	55	04.51	469.05	10	4	35	12.653	126.606	16	46	28.95	247.00
11	2	55	52.964	126.965	12	02	53.56	464.98	11	4	37	19.259	126.592	16	50	35.95	241.96
12	2	57	59.929	126.955	12	10	38.54	460.88	12	4	39	25.851	126.579	16	54	37.91	236.91
13	3	00	06.884	126.946	12	18	19.42	456.76	13	4	41	32.430	126.565	16	58	34.82	231.84
14	3	02	13.830	126.937	12	25	56.18	452.60	14	4	43	38.995	126.550	17	02	26.66	226.78
15	3	04	20.767	126.929	12	33	28.78	448.41	15	4	45	45.545	126.536	17	06	13.44	221.70
16	3	06	27.696	126.920	12	40	57.19	444.20	16	4	47	52.081	126.519	17	09	55.14	216.61
17	3	08	34.616	126.913	12	48	21.39	439.96	17	4	49	58.600	126.504	17	13	31.75	211.52
18	3	10	41.529	126.905	12	55	41.35	435.68	18	4	52	05.104	126.487	17	17	03.27	206.41
19	3	12	48.434	126.898	13	02	57.03	431.38	19	4	54	11.591	126.469	17	20	29.68	201.31
20	3	14	55.332	126.891	13	10	08.41	427.06	20	4	56	18.060	126.452	17	23	50.99	196.19
21	3	17	02.223	126.884	13	17	15.47	422.71	21	4	58	24.512	126.433	17	27	07.18	191.06
22	3	19	09.107	126.878	13	24	18.18	418.32	22	5	00	30.945	126.415	17	30	18.24	185.93
23	3	21	15.985	126.872	+13	31	16.50	+113.93	23	5	02	37.360	126.394	+17	33	24.17	+180.80
October 8									October 10								
0	3	23	22.857	126.865	+13	38	10.43	+409.49	0	5	04	43.754	126.374	+17	36	24.97	+175.65
1	3	25	29.722	126.859	13	44	59.92	405.04	1	5	06	50.128	126.354	17	39	20.62	170.51
2	3	27	36.581	126.854	13	51	44.96	400.55	2	5	08	56.482	126.332	17	42	11.13	165.35
3	3	29	43.435	126.847	13	58	25.51	396.06	3	5	11	02.814	126.310	17	44	56.48	160.20
4	3	31	50.282	126.842	14	05	01.57	391.53	4	5	13	09.124	126.287	17	47	36.68	155.03
5	3	33	57.124	126.837	14	11	33.10	386.98	5	5	15	15.411	126.263	17	50	11.71	149.87
6	3	36	03.961	126.830	14	18	00.08	382.41	6	5	17	21.674	126.240	17	52	41.58	144.70
7	3	38	10.791	126.825	14	24	22.49	377.81	7	5	19	27.914	126.215	17	55	06.28	139.53
8	3	40	17.616	126.820	14	30	40.30	373.20	8	5	21	34.129	126.189	17	57	25.81	134.36
9	3	42	24.436	126.814	14	36	53.50	368.57	9	5	23	40.318	126.164	17	59	40.17	129.17
10	3	44	31.250	126.808	14	43	02.07	363.90	10	5	25	46.482	126.137	18	01	49.34	124.00
11	3	46	38.058	126.802	14	49	05.97	359.23	11	5	27	52.619	126.109	18	03	53.34	118.81
12	3	48	44.860	126.796	14	55	05.20	354.53	12	5	29	58.728	126.082	18	05	52.15	113.63
13	3	50	51.656	126.791	15	00	59.73	349.81	13	5	32	04.810	126.053	18	07	45.78	108.45
14	3	52	58.447	126.784	15	06	49.54	345.08	14	5	34	10.863	126.023	18	09	34.23	103.26
15	3	55	05.231	126.778	15	12	34.62	340.32	15	5	36	16.886	125.994	18	11	17.49	98.07
16	3	57	12.009	126.771	15	18	14.94	335.55	16	5	38	22.880	125.963	18	12	55.56	92.88
17	3	59	18.780	126.765	15	23	50.49	330.76	17	5	40	28.843	125.932	18	14	28.44	87.70
18	4	01	25.545	126.758	15	29	21.25	325.95	18	5	42	34.775	125.899	18	15	56.14	82.51
19	4	03	32.303	126.751	15	34	47.20	321.13	19	5	44	40.674	125.867	18	17	18.65	77.33
20	4	05	39.054	126.744	15	40	08.33	316.28	20	5	46	46.541	125.834	18	18	35.98	72.14
21	4	07	45.798	126.736	15	45	24.61	311.43	21	5	48	52.375	125.800	18	19	48.12	66.96
22	4	09	52.534	126.728	15	50	36.04	306.55	22	5	50	58.175	125.765	18	20	55.08	61.77
23	4	11	59.262	126.720	15	55	42.59	+301.66	23	5	53	03.940	125.730	18	21	56.85	+56.60
24	4	14	05.982		+16	00	44.25		24	5	55	09.670		+18	22	53.45	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
October 11							October 13						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	5 55	09	670	125°694	+18 22 53.45	51.41	0	7 34	52	479	123°391	+17 28 19.33	189.63
1	5 57	15	364	125°658	18 23 44.86	46.24	1	7 36	55	870	123°338	17 25 09.70	194.40
2	5 59	21	022	125°620	18 24 31.10	41.07	2	7 38	59	208	123°283	17 21 55.30	199.15
3	6 01	26	642	125°582	18 25 12.17	35.90	3	7 41	02	491	123°228	17 18 36.15	203.99
4	6 03	32	224	125°545	18 25 48.07	30.73	4	7 43	05	719	123°175	17 15 12.25	208.66
5	6 05	37	769	125°505	18 26 18.80	25.56	5	7 45	08	894	123°120	17 11 43.62	213.34
6	6 07	43	274	125°465	18 26 44.36	20.41	6	7 47	12	014	123°067	17 08 10.28	218.04
7	6 09	48	739	125°425	18 27 04.77	15.24	7	7 49	15	081	123°012	17 04 32.24	222.72
8	6 11	54	164	125°384	18 27 20.01	10.10	8	7 51	18	093	122°959	17 00 49.52	227.40
9	6 13	59	548	125°343	18 27 30.11	4.95	9	7 53	21	052	122°906	16 57 02.12	232.05
10	6 16	04	891	125°301	18 27 35.06	0.19	10	7 55	23	958	122°852	16 53 10.07	236.69
11	6 18	10	192	125°258	18 27 34.87	5.33	11	7 57	26	810	122°799	16 49 13.38	241.32
12	6 20	15	450	125°215	18 27 29.54	10.47	12	7 59	29	609	122°746	16 45 12.06	245.93
13	6 22	20	665	125°171	18 27 19.07	15.59	13	8 01	32	355	122°694	16 41 06.13	250.51
14	6 24	25	836	125°127	18 27 03.48	20.71	14	8 03	35	049	122°642	16 36 55.62	255.10
15	6 26	30	963	125°081	18 26 42.77	25.82	15	8 05	37	691	122°590	16 32 40.52	259.66
16	6 28	36	044	125°037	18 26 16.95	30.93	16	8 07	40	281	122°538	16 28 20.86	264.20
17	6 30	41	081	124°991	18 25 46.02	36.04	17	8 09	42	819	122°487	16 23 56.66	268.73
18	6 32	46	072	124°944	18 25 09.98	41.12	18	8 11	45	306	122°436	16 19 27.93	273.25
19	6 34	51	016	124°898	18 24 28.86	46.22	19	8 13	47	742	122°385	16 14 54.68	277.74
20	6 36	55	914	124°850	18 23 42.64	51.30	20	8 15	50	127	122°336	16 10 16.94	282.21
21	6 39	00	764	124°802	18 22 51.34	56.36	21	8 17	52	463	122°286	16 05 34.73	286.68
22	6 41	05	566	124°755	18 21 54.98	61.44	22	8 19	54	749	122°237	16 00 48.05	291.12
23	6 43	10	321	124°705	+18 20 53.54	66.49	23	8 21	56	986	122°188	+15 55 56.93	295.55
October 12							October 14						
0	6 45	15	026	124°656	+18 19 47.05	71.53	0	8 23	59	174	122°141	+15 51 01.38	299.96
1	6 47	19	682	124°607	18 18 35.52	76.58	1	8 26	01	315	122°092	15 46 01.42	304.34
2	6 49	24	289	124°557	18 17 18.94	81.60	2	8 28	03	407	122°046	15 40 57.08	308.72
3	6 51	28	846	124°507	18 15 57.34	86.63	3	8 30	05	453	121°999	15 35 48.36	313.08
4	6 53	33	353	124°456	18 14 30.71	91.64	4	8 32	07	452	121°954	15 30 35.28	317.40
5	6 55	37	809	124°404	18 12 59.07	96.65	5	8 34	09	406	121°908	15 25 17.88	321.73
6	6 57	42	213	124°354	18 11 22.42	101.64	6	8 36	11	314	121°864	15 19 56.15	326.02
7	6 59	46	567	124°302	18 09 40.78	106.62	7	8 38	13	178	121°821	15 14 30.13	330.31
8	7 01	50	869	124°250	18 07 54.16	111.59	8	8 40	14	999	121°777	15 08 59.82	334.56
9	7 03	55	119	124°198	18 06 02.57	116.56	9	8 42	16	776	121°734	15 03 25.26	338.80
10	7 05	59	317	124°145	18 04 06.01	121.51	10	8 44	18	510	121°693	14 57 46.46	343.03
11	7 08	03	462	124°092	18 02 04.50	126.46	11	8 46	20	203	121°652	14 52 03.43	347.22
12	7 10	07	554	124°039	17 59 58.04	131.38	12	8 48	21	855	121°612	14 46 16.21	351.41
13	7 12	11	593	123°987	17 57 46.66	136.30	13	8 50	23	467	121°573	14 40 24.80	355.56
14	7 14	15	580	123°932	17 55 30.36	141.22	14	8 52	25	040	121°534	14 34 29.24	359.71
15	7 16	19	512	123°879	17 53 09.14	146.10	15	8 54	26	574	121°497	14 28 29.53	363.83
16	7 18	23	391	123°826	17 50 43.04	151.00	16	8 56	28	071	121°460	14 22 25.70	367.93
17	7 20	27	217	123°771	17 48 12.04	155.87	17	8 58	29	531	121°425	14 16 17.77	372.00
18	7 22	30	988	123°717	17 45 36.17	160.72	18	9 00	30	956	121°389	14 10 05.77	376.07
19	7 24	34	705	123°664	17 42 55.45	165.58	19	9 02	32	345	121°355	14 03 49.70	380.10
20	7 26	38	369	123°609	17 40 09.87	170.41	20	9 04	33	700	121°323	13 57 29.60	384.11
21	7 28	41	978	123°554	17 37 19.46	175.24	21	9 06	35	023	121°290	13 51 05.49	388.11
22	7 30	45	532	123°501	17 34 24.22	180.05	22	9 08	36	313	121°260	13 44 37.38	392.07
23	7 32	49	033	123°446	17 31 24.17	184.84	23	9 10	37	573	121°230	13 38 05.31	396.03
24	7 34	52	479		+17 28 19.33		24	9 12	38	803		+13 31 29.28	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 15			October 17		
h	h m s	s	h	h m s	s
0	9 12 38.803	121.201	0	10 49 28.072	121.451
1	9 14 40.004	121.173	1	10 51 29.523	121.499
2	9 16 41.177	121.146	2	10 53 31.022	121.547
3	9 18 42.323	121.121	3	10 55 32.569	121.598
4	9 20 43.444	121.096	4	10 57 34.167	121.650
5	9 22 44.540	121.073	5	10 59 35.817	121.705
6	9 24 45.613	121.051	6	11 01 37.522	121.761
7	9 26 46.664	121.031	7	11 03 39.283	121.820
8	9 28 47.695	121.010	8	11 05 41.103	121.881
9	9 30 48.705	120.992	9	11 07 42.984	121.942
10	9 32 49.697	120.975	10	11 09 44.926	122.008
11	9 34 50.672	120.959	11	11 11 46.934	122.074
12	9 36 51.631	120.945	12	11 13 49.008	122.143
13	9 38 52.576	120.931	13	11 15 51.151	122.214
14	9 40 53.507	120.920	14	11 17 53.365	122.286
15	9 42 54.427	120.909	15	11 19 55.651	122.362
16	9 44 55.336	120.900	16	11 21 58.013	122.438
17	9 46 56.236	120.893	17	11 24 00.451	122.518
18	9 48 57.129	120.886	18	11 26 02.969	122.598
19	9 50 58.015	120.881	19	11 28 05.567	122.683
20	9 52 58.896	120.878	20	11 30 08.250	122.767
21	9 54 59.774	120.876	21	11 32 11.017	122.855
22	9 57 00.650	120.876	22	11 34 13.872	122.945
23	9 59 01.526	120.877	23	11 36 16.817	123.037
October 16			October 18		
0	10 01 02.403	120.880	0	11 38 19.854	123.131
1	10 03 03.283	120.884	1	11 40 22.985	123.227
2	10 05 04.167	120.889	2	11 42 26.212	123.325
3	10 07 05.056	120.898	3	11 44 29.537	123.426
4	10 09 05.954	120.906	4	11 46 32.963	123.528
5	10 11 06.860	120.917	5	11 48 36.491	123.633
6	10 13 07.777	120.930	6	11 50 40.124	123.740
7	10 15 08.707	120.943	7	11 52 43.864	123.849
8	10 17 09.650	120.959	8	11 54 47.713	123.961
9	10 19 10.609	120.977	9	11 56 51.674	124.074
10	10 21 11.586	120.995	10	11 58 55.748	124.189
11	10 23 12.581	121.017	11	12 00 59.937	124.307
12	10 25 13.598	121.039	12	12 03 04.244	124.428
13	10 27 14.637	121.063	13	12 05 08.672	124.549
14	10 29 15.700	121.089	14	12 07 13.221	124.674
15	10 31 16.789	121.118	15	12 09 17.895	124.800
16	10 33 17.907	121.147	16	12 11 22.695	124.928
17	10 35 19.054	121.179	17	12 13 27.623	125.060
18	10 37 20.233	121.212	18	12 15 32.683	125.192
19	10 39 21.445	121.247	19	12 17 37.875	125.328
20	10 41 22.692	121.285	20	12 19 43.203	125.464
21	10 43 23.977	121.323	21	12 21 48.667	125.605
22	10 45 25.300	121.364	22	12 23 54.272	125.745
23	10 47 26.664	121.408	23	12 26 00.017	125.889
24	10 49 28.072		24	12 28 05.906	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 19			October 21		
h	h m s	° ' " "	h	h m s	° ' " "
0	12 28 05.906 ^s 126.035	- 0 56 25.16 ^s -631.37	0	14 12 15.724 ^s 135.199	- 9 10 37.43 ^s -578.24
1	12 30 11.941 126.183	1 06 56.53 631.72	1	14 14 30.923 135.424	9 20 15.67 575.49
2	12 32 18.124 126.333	1 17 28.25 632.01	2	14 16 46.347 135.650	9 29 51.16 572.67
3	12 34 24.457 126.485	1 28 00.26 632.24	3	14 19 01.997 135.877	9 39 23.83 569.79
4	12 36 30.942 126.639	1 38 32.50 632.42	4	14 21 17.874 136.103	9 48 53.62 566.81
5	12 38 37.581 126.795	1 49 04.92 632.54	5	14 23 33.977 136.331	9 58 20.43 563.79
6	12 40 44.376 126.954	1 59 37.46 632.61	6	14 25 50.308 136.558	10 07 44.22 560.68
7	12 42 51.330 127.114	2 10 10.07 632.61	7	14 28 06.866 136.787	10 17 04.90 557.51
8	12 44 58.444 127.276	2 20 42.68 632.55	8	14 30 23.653 137.017	10 26 22.41 554.27
9	12 47 05.720 127.441	2 31 15.23 632.45	9	14 32 40.670 137.245	10 35 36.68 550.94
10	12 49 13.161 127.607	2 41 47.68 632.27	10	14 34 57.915 137.475	10 44 47.62 547.56
11	12 51 20.768 127.776	2 52 19.95 632.04	11	14 37 15.390 137.704	10 53 55.18 544.10
12	12 53 28.544 127.946	3 02 51.99 631.75	12	14 39 33.094 137.935	11 02 59.28 540.57
13	12 55 36.490 128.118	3 13 23.74 631.40	13	14 41 51.029 138.164	11 11 59.85 536.97
14	12 57 44.608 128.293	3 23 55.14 630.98	14	14 44 09.193 138.395	11 20 56.82 533.30
15	12 59 52.901 128.469	3 34 26.12 630.51	15	14 46 27.588 138.625	11 29 50.12 529.55
16	13 02 01.370 128.647	3 44 56.63 629.98	16	14 48 46.213 138.854	11 38 39.67 525.75
17	13 04 10.017 128.827	3 55 26.61 629.38	17	14 51 05.067 139.085	11 47 25.42 521.86
18	13 06 18.844 129.010	4 05 55.99 628.72	18	14 53 24.152 139.314	11 56 07.28 517.91
19	13 08 27.854 129.192	4 16 24.71 627.99	19	14 55 43.466 139.543	12 04 45.19 513.88
20	13 10 37.046 129.379	4 26 52.70 627.21	20	14 58 03.009 139.773	12 13 19.07 509.79
21	13 12 46.425 129.566	4 37 19.91 626.36	21	15 00 22.782 140.001	12 21 48.86 505.63
22	13 14 55.991 129.755	4 47 46.27 625.45	22	15 02 42.783 140.229	12 30 14.49 501.39
23	13 17 05.746 129.946	- 4 58 11.72 -624.47	23	15 05 03.012 140.456	-12 38 35.88 -497.10
October 20			October 22		
0	13 19 15.692 130.139	- 5 08 36.19 -623.42	0	15 07 23.468 140.684	-12 46 52.98 -492.72
1	13 21 25.831 130.333	5 18 59.61 622.32	1	15 09 44.152 140.909	12 55 05.70 488.28
2	13 23 36.164 130.529	5 29 21.93 621.15	2	15 12 05.061 141.135	13 03 13.98 483.77
3	13 25 46.693 130.727	5 39 43.08 619.91	3	15 14 26.196 141.360	13 11 17.75 479.20
4	13 27 57.420 130.926	5 50 02.99 618.61	4	15 16 47.556 141.584	13 19 16.95 474.55
5	13 30 08.346 131.127	6 00 21.60 617.23	5	15 19 09.140 141.806	13 27 11.50 469.85
6	13 32 19.473 131.330	6 10 38.83 615.80	6	15 21 30.946 142.027	13 35 01.35 465.06
7	13 34 30.803 131.533	6 20 54.63 614.29	7	15 23 52.973 142.249	13 42 46.41 460.22
8	13 36 42.336 131.739	6 31 08.92 612.72	8	15 26 15.222 142.467	13 50 26.63 455.31
9	13 38 54.075 131.946	6 41 21.64 611.09	9	15 28 37.689 142.686	13 58 01.94 450.33
10	13 41 06.021 132.155	6 51 32.73 609.37	10	15 31 00.375 142.902	14 05 32.27 445.28
11	13 43 18.176 132.364	7 01 42.10 607.60	11	15 33 23.277 143.117	14 12 57.55 440.18
12	13 45 30.540 132.575	7 11 49.70 605.76	12	15 35 46.394 143.331	14 20 17.73 435.01
13	13 47 43.115 132.788	7 21 55.46 603.85	13	15 38 09.725 143.544	14 27 32.74 429.77
14	13 49 55.903 133.001	7 31 59.31 601.87	14	15 40 33.269 143.753	14 34 42.51 424.48
15	13 52 08.904 133.216	7 42 01.18 599.82	15	15 42 57.022 143.963	14 41 46.99 419.11
16	13 54 22.120 133.433	7 52 01.00 597.70	16	15 45 20.985 144.169	14 48 46.10 413.69
17	13 56 35.553 133.650	8 01 58.70 595.51	17	15 47 45.154 144.374	14 55 39.79 408.20
18	13 58 49.203 133.868	8 11 54.21 593.25	18	15 50 09.528 144.578	15 02 27.99 402.65
19	14 01 03.071 134.088	8 21 47.46 590.93	19	15 52 34.106 144.778	15 09 10.64 397.05
20	14 03 17.159 134.308	8 31 38.39 588.53	20	15 54 58.884 144.977	15 15 47.69 391.38
21	14 05 31.467 134.529	8 41 26.92 586.07	21	15 57 23.861 145.174	15 22 19.07 385.66
22	14 07 45.996 134.752	8 51 12.99 583.52	22	15 59 49.035 145.368	15 28 44.73 379.87
23	14 10 00.748 134.976	9 00 56.51 580.92	23	16 02 14.403 145.561	15 35 04.60 374.03
24	14 12 15.724	- 9 10 37.43	24	16 04 39.964	-15 41 18.63

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 23			October 25		
h	h m s	° ' "	h	h m s	° ' "
0	16 04 39.964	145° 750	0	18 03 49.737	150° 751
1	16 07 05.714	145° 937	1	18 06 20.488	150° 751
2	16 09 31.651	146° 121	2	18 08 51.239	150° 747
3	16 11 57.772	146° 304	3	18 11 21.986	150° 739
4	16 14 24.076	146° 483	4	18 13 52.725	150° 724
5	16 16 50.559	146° 659	5	18 16 23.449	150° 707
6	16 19 17.218	146° 832	6	18 18 54.156	150° 685
7	16 21 44.050	147° 003	7	18 21 24.841	150° 657
8	16 24 11.053	147° 171	8	18 23 55.498	150° 627
9	16 26 38.224	147° 335	9	18 26 26.125	150° 590
10	16 29 05.559	147° 497	10	18 28 56.715	150° 549
11	16 31 33.056	147° 654	11	18 31 27.264	150° 505
12	16 34 00.710	147° 810	12	18 33 57.769	150° 456
13	16 36 28.520	147° 961	13	18 36 28.225	150° 402
14	16 38 56.481	148° 109	14	18 38 58.627	150° 344
15	16 41 24.590	148° 253	15	18 41 28.971	150° 281
16	16 43 52.843	148° 395	16	18 43 59.252	150° 215
17	16 46 21.238	148° 532	17	18 46 29.467	150° 145
18	16 48 49.770	148° 666	18	18 48 59.612	150° 069
19	16 51 18.436	148° 796	19	18 51 29.681	149° 990
20	16 53 47.232	148° 922	20	18 53 59.671	149° 908
21	16 56 16.154	149° 045	21	18 56 29.579	149° 819
22	16 58 45.199	149° 163	22	18 58 59.398	149° 729
23	17 01 14.362	149° 278	23	19 01 29.127	149° 633
October 24			October 26		
h	h m s	° ' "	h	h m s	° ' "
0	17 03 43.640	149° 389	0	19 03 58.760	149° 535
1	17 06 13.029	149° 495	1	19 06 28.295	149° 431
2	17 08 42.524	149° 598	2	19 08 57.726	149° 324
3	17 11 12.122	149° 696	3	19 11 27.050	149° 214
4	17 13 41.818	149° 790	4	19 13 56.264	149° 100
5	17 16 11.608	149° 881	5	19 16 25.364	148° 982
6	17 18 41.489	149° 966	6	19 18 54.346	148° 860
7	17 21 11.455	150° 048	7	19 21 23.206	148° 736
8	17 23 41.503	150° 125	8	19 23 51.942	148° 607
9	17 26 11.628	150° 197	9	19 26 20.549	148° 476
10	17 28 41.825	150° 266	10	19 28 49.025	148° 341
11	17 31 12.091	150° 330	11	19 31 17.366	148° 202
12	17 33 42.421	150° 390	12	19 33 45.568	148° 061
13	17 36 12.811	150° 445	13	19 36 13.629	147° 916
14	17 38 43.256	150° 495	14	19 38 41.545	147° 769
15	17 41 13.751	150° 542	15	19 41 09.314	147° 619
16	17 43 44.293	150° 583	16	19 43 36.933	147° 465
17	17 46 14.876	150° 620	17	19 46 04.398	147° 309
18	17 48 45.496	150° 652	18	19 48 31.707	147° 150
19	17 51 16.148	150° 680	19	19 50 58.857	146° 989
20	17 53 46.828	150° 704	20	19 53 25.846	146° 824
21	17 56 17.532	150° 722	21	19 55 52.670	146° 658
22	17 58 48.254	150° 737	22	19 58 19.328	146° 488
23	18 01 18.991	150° 746	23	20 00 45.816	146° 317
24	18 03 49.737	150° 746	24	20 03 12.133	146° 317

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 27			October 29		
h	h m s	° ' "	h	h m s	° ' "
0	20 03 12.133	-16 43 09.83	0	21 56 26.688	-10 57 29.66
1	20 05 38.277	146.144	1	21 58 43.293	10 48 26.30
2	20 08 04.244	145.967	2	22 00 59.703	10 39 19.43
3	20 10 30.034	145.790	3	22 03 15.918	10 30 09.10
4	20 12 55.643	145.609	4	22 05 31.940	10 20 55.37
5	20 15 21.070	145.427	5	22 07 47.770	10 11 38.31
6	20 17 46.314	145.244	6	22 10 03.409	10 02 17.98
7	20 20 11.371	145.057	7	22 12 18.859	9 52 54.44
8	20 22 36.241	144.870	8	22 14 34.120	9 43 27.76
9	20 25 00.922	144.681	9	22 16 49.195	9 33 58.00
10	20 27 25.412	144.490	10	22 19 04.084	9 24 25.23
11	20 29 49.710	144.298	11	22 21 18.789	9 14 49.50
12	20 32 13.814	144.104	12	22 23 33.312	9 05 10.88
13	20 34 37.723	143.909	13	22 25 47.654	8 55 29.44
14	20 37 01.436	143.713	14	22 28 01.816	8 45 45.23
15	20 39 24.951	143.515	15	22 30 15.801	8 35 58.32
16	20 41 48.268	143.317	16	22 32 29.610	8 26 08.78
17	20 44 11.385	143.117	17	22 34 43.244	8 16 16.66
18	20 46 34.301	142.916	18	22 36 56.705	8 06 22.03
19	20 48 57.016	142.715	19	22 39 09.995	7 56 24.96
20	20 51 19.529	142.513	20	22 41 23.116	7 46 25.50
21	20 53 41.839	142.310	21	22 43 36.069	7 36 23.72
22	20 56 03.945	142.106	22	22 45 48.856	7 26 19.68
23	20 58 25.847	141.902	23	22 48 01.479	7 16 13.44
		141.697			+608.36
		+435.13			
October 28			October 30		
0	21 00 47.544	-14 14 31.18	0	22 50 13.941	-7 06 05.08
1	21 03 09.035	141.491	1	22 52 26.242	6 55 54.64
2	21 05 30.322	141.287	2	22 54 38.385	6 45 42.20
3	21 07 51.402	141.080	3	22 56 50.371	6 35 27.81
4	21 10 12.276	140.874	4	22 59 02.203	6 25 11.54
5	21 12 32.944	140.668	5	23 01 13.882	6 14 53.45
6	21 14 53.405	140.461	6	23 03 25.411	6 04 33.60
7	21 17 13.660	140.255	7	23 05 36.791	5 54 12.06
8	21 19 33.709	140.049	8	23 07 48.025	5 43 48.88
9	21 21 53.551	139.842	9	23 09 59.114	5 33 24.13
10	21 24 13.187	139.636	10	23 12 10.061	5 22 57.88
11	21 26 32.617	139.430	11	23 14 20.868	5 12 30.18
12	21 28 51.842	139.225	12	23 16 31.536	5 02 01.09
13	21 31 10.861	139.019	13	23 18 42.068	4 51 30.68
14	21 33 29.676	138.815	14	23 20 52.465	4 40 59.00
15	21 35 48.286	138.610	15	23 23 02.731	4 30 26.13
16	21 38 06.692	138.406	16	23 25 12.867	4 19 52.11
17	21 40 24.896	138.204	17	23 27 22.875	4 09 17.02
18	21 42 42.896	138.000	18	23 29 32.758	3 58 40.90
19	21 45 00.695	137.799	19	23 31 42.517	3 48 03.84
20	21 47 18.292	137.597	20	23 33 52.154	3 37 25.87
21	21 49 35.690	137.398	21	23 36 01.673	3 26 47.07
22	21 51 52.887	137.197	22	23 38 11.074	3 16 07.49
23	21 54 09.887	137.000	23	23 40 20.361	3 05 27.20
24	21 56 26.688	136.801	24	23 42 29.535	2 54 46.26
		+539.76			+640.94

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 31			November 2		
h	h m s	° ' " s	h	h m s	° ' " s
0	23 42 29.535	129.063	0	1 24 18.915	126.194
1	23 44 38.598	128.955	1	1 26 25.109	126.181
2	23 46 47.553	128.849	2	1 28 31.290	126.167
3	23 48 56.402	128.745	3	1 30 37.457	126.155
4	23 51 05.147	128.643	4	1 32 43.612	126.146
5	23 53 13.790	128.544	5	1 34 49.758	126.136
6	23 55 22.334	128.446	6	1 36 55.894	126.130
7	23 57 30.780	128.351	7	1 39 02.024	126.123
8	23 59 39.131	128.257	8	1 41 08.147	126.119
9	0 01 47.388	128.167	9	1 43 14.266	126.116
10	0 03 55.555	128.078	10	1 45 20.382	126.114
11	0 06 03.633	127.991	11	1 47 26.496	126.113
12	0 08 11.624	127.907	12	1 49 32.609	126.114
13	0 10 19.531	127.824	13	1 51 38.723	126.115
14	0 12 27.355	127.744	14	1 53 44.838	126.119
15	0 14 35.099	127.666	15	1 55 50.957	126.122
16	0 16 42.765	127.590	16	1 57 57.079	126.128
17	0 18 50.355	127.516	17	2 00 03.207	126.134
18	0 20 57.871	127.444	18	2 02 09.341	126.141
19	0 23 05.315	127.375	19	2 04 15.482	126.150
20	0 25 12.690	127.307	20	2 06 21.632	126.159
21	0 27 19.997	127.241	21	2 08 27.791	126.170
22	0 29 27.238	127.178	22	2 10 33.961	126.181
23	0 31 34.416	127.116	23	2 12 40.142	126.193
November 1			November 3		
0	0 33 41.532	127.057	0	2 14 46.335	126.206
1	0 35 48.589	127.000	1	2 16 52.541	126.220
2	0 37 55.589	126.944	2	2 18 58.761	126.235
3	0 40 02.533	126.891	3	2 21 04.996	126.250
4	0 42 09.424	126.839	4	2 23 11.246	126.266
5	0 44 16.263	126.790	5	2 25 17.512	126.284
6	0 46 23.053	126.742	6	2 27 23.796	126.301
7	0 48 29.795	126.696	7	2 29 30.097	126.320
8	0 50 36.491	126.653	8	2 31 36.417	126.338
9	0 52 43.144	126.611	9	2 33 42.755	126.358
10	0 54 49.755	126.570	10	2 35 49.113	126.378
11	0 56 56.325	126.533	11	2 37 55.491	126.398
12	0 59 02.858	126.496	12	2 40 01.889	126.420
13	1 01 09.354	126.462	13	2 42 08.309	126.441
14	1 03 15.816	126.429	14	2 44 14.750	126.463
15	1 05 22.245	126.397	15	2 46 21.213	126.485
16	1 07 28.642	126.369	16	2 48 27.698	126.508
17	1 09 35.011	126.341	17	2 50 34.206	126.531
18	1 11 41.352	126.315	18	2 52 40.737	126.555
19	1 13 47.667	126.292	19	2 54 47.292	126.578
20	1 15 53.959	126.268	20	2 56 53.870	126.601
21	1 18 00.227	126.248	21	2 59 00.471	126.626
22	1 20 06.475	126.229	22	3 01 07.097	126.649
23	1 22 12.704	126.211	23	3 03 13.746	126.674
24	1 24 18.915		24	3 05 20.420	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
November 4									November 6								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	3	05	20.420	126.698	+12	41	20.20	+451.22	0	4	47	03.950	127.384	+17	16	51.84	+224.36
1	3	07	27.118	126.723	12	48	51.42	447.09	1	4	49	11.334	127.379	17	20	36.20	219.17
2	3	09	33.841	126.747	12	56	18.51	442.95	2	4	51	18.713	127.371	17	24	15.37	214.00
3	3	11	40.588	126.771	13	03	41.46	438.75	3	4	53	26.084	127.363	17	27	49.37	208.80
4	3	13	47.359	126.796	13	11	00.21	434.54	4	4	55	33.447	127.353	17	31	18.17	203.59
5	3	15	54.155	126.820	13	18	14.75	430.29	5	4	57	40.800	127.342	17	34	41.76	198.38
6	3	18	00.975	126.844	13	25	25.04	426.00	6	4	59	48.142	127.330	17	38	00.14	193.17
7	3	20	07.819	126.869	13	32	31.04	421.70	7	5	01	55.472	127.317	17	41	13.31	187.93
8	3	22	14.688	126.892	13	39	32.74	417.35	8	5	04	02.789	127.302	17	44	21.24	182.69
9	3	24	21.580	126.916	13	46	30.09	412.99	9	5	06	10.091	127.287	17	47	23.93	177.45
10	3	26	28.496	126.939	13	53	23.08	408.58	10	5	08	17.378	127.270	17	50	21.38	172.20
11	3	28	35.435	126.962	14	00	11.66	404.16	11	5	10	24.648	127.252	17	53	13.58	166.94
12	3	30	42.397	126.986	14	06	55.82	399.70	12	5	12	31.900	127.232	17	56	00.52	161.68
13	3	32	49.383	127.008	14	13	35.52	395.22	13	5	14	39.132	127.212	17	58	42.20	156.41
14	3	34	56.391	127.030	14	20	10.74	390.70	14	5	16	46.344	127.190	18	01	18.61	151.13
15	3	37	03.421	127.052	14	26	41.44	386.17	15	5	18	53.534	127.166	18	03	49.74	145.86
16	3	39	10.473	127.073	14	33	07.61	381.60	16	5	21	00.700	127.142	18	06	15.60	140.58
17	3	41	17.546	127.095	14	39	29.21	377.00	17	5	23	07.842	127.117	18	08	36.18	135.29
18	3	43	24.641	127.115	14	45	46.21	372.40	18	5	25	14.959	127.089	18	10	51.47	130.00
19	3	45	31.756	127.135	14	51	58.61	367.75	19	5	27	22.048	127.062	18	13	01.47	124.71
20	3	47	38.891	127.154	14	58	06.36	363.08	20	5	29	29.110	127.031	18	15	06.18	119.42
21	3	49	46.045	127.173	15	04	09.44	358.40	21	5	31	36.141	127.002	18	17	05.60	114.13
22	3	51	53.218	127.192	15	10	07.84	353.68	22	5	33	43.143	126.969	18	18	59.73	108.83
23	3	54	00.410	127.210	+15	16	01.52	+348.94	23	5	35	50.112	126.935	+18	20	48.56	+103.53
November 5									November 7								
0	3	56	07.620	127.226	+15	21	50.46	+344.18	0	5	37	57.047	126.902	+18	22	32.09	+98.23
1	3	58	14.846	127.243	15	27	34.64	339.40	1	5	40	03.949	126.865	18	24	10.32	92.93
2	4	00	22.089	127.259	15	33	14.04	334.60	2	5	42	10.814	126.829	18	25	43.25	87.64
3	4	02	29.348	127.274	15	38	48.64	329.77	3	5	44	17.643	126.790	18	27	10.89	82.34
4	4	04	36.622	127.288	15	44	18.41	324.92	4	5	46	24.433	126.751	18	28	33.23	77.04
5	4	06	43.910	127.301	15	49	43.33	320.06	5	5	48	31.184	126.709	18	29	50.27	71.75
6	4	08	51.211	127.315	15	55	03.39	315.17	6	5	50	37.893	126.668	18	31	02.02	66.46
7	4	10	58.526	127.326	16	00	18.56	310.27	7	5	52	44.561	126.625	18	32	08.48	61.17
8	4	13	05.852	127.337	16	05	28.83	305.34	8	5	54	51.186	126.580	18	33	09.65	55.88
9	4	15	13.189	127.348	16	10	34.17	300.40	9	5	56	57.766	126.535	18	34	05.53	50.59
10	4	17	20.537	127.357	16	15	34.57	295.43	10	5	59	04.301	126.488	18	34	56.12	45.32
11	4	19	27.894	127.366	16	20	30.00	290.46	11	6	01	10.789	126.440	18	35	41.44	40.03
12	4	21	35.260	127.373	16	25	20.46	285.46	12	6	03	17.229	126.391	18	36	21.47	34.77
13	4	23	42.633	127.379	16	30	05.92	280.45	13	6	05	23.620	126.340	18	36	56.24	29.50
14	4	25	50.012	127.385	16	34	46.37	275.41	14	6	07	29.960	126.289	18	37	25.74	24.23
15	4	27	57.397	127.390	16	39	21.78	270.38	15	6	09	36.249	126.237	18	37	49.97	18.98
16	4	30	04.787	127.394	16	43	52.16	265.31	16	6	11	42.486	126.183	18	38	08.95	13.72
17	4	32	12.181	127.396	16	48	17.47	260.25	17	6	13	48.669	126.128	18	38	22.67	8.48
18	4	34	19.577	127.398	16	52	37.72	255.15	18	6	15	54.797	126.072	18	38	31.15	+3.24
19	4	36	26.975	127.398	16	56	52.87	250.05	19	6	18	00.869	126.015	18	38	34.39	-2.00
20	4	38	34.373	127.398	17	01	02.92	244.93	20	6	20	06.884	125.957	18	38	32.39	-7.22
21	4	40	41.771	127.396	17	05	07.85	239.81	21	6	22	12.841	125.898	18	38	25.17	-12.43
22	4	42	49.167	127.393	17	09	07.66	234.67	22	6	24	18.739	125.838	18	38	12.74	-17.65
23	4	44	56.560	127.390	17	13	02.33	+229.51	23	6	26	24.577	125.777	18	37	55.09	-22.85
24	4	47	03.950		+17	16	51.84		24	6	28	30.354		+18	37	32.24	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 8			November 10		
h	h m s	s	h	h m s	s
0	6 28 30.354	125.714	0	8 07 41.821	122.049
1	6 30 36.068	125.652	1	8 09 43.870	121.970
2	6 32 41.720	125.588	2	8 11 45.840	121.891
3	6 34 47.308	125.523	3	8 13 47.731	121.813
4	6 36 52.831	125.457	4	8 15 49.544	121.735
5	6 38 58.288	125.390	5	8 17 51.279	121.658
6	6 41 03.678	125.323	6	8 19 52.937	121.580
7	6 43 09.001	125.254	7	8 21 54.517	121.505
8	6 45 14.255	125.185	8	8 23 56.022	121.429
9	6 47 19.440	125.115	9	8 25 57.451	121.354
10	6 49 24.555	125.045	10	8 27 58.805	121.280
11	6 51 29.600	124.972	11	8 30 00.085	121.206
12	6 53 34.572	124.901	12	8 32 01.291	121.134
13	6 55 39.473	124.827	13	8 34 02.425	121.061
14	6 57 44.300	124.754	14	8 36 03.486	120.989
15	6 59 49.054	124.679	15	8 38 04.475	120.919
16	7 01 53.733	124.605	16	8 40 05.394	120.849
17	7 03 58.338	124.529	17	8 42 06.243	120.781
18	7 06 02.867	124.452	18	8 44 07.024	120.712
19	7 08 07.319	124.377	19	8 46 07.736	120.646
20	7 10 11.696	124.299	20	8 48 08.382	120.579
21	7 12 15.995	124.221	21	8 50 08.961	120.514
22	7 14 20.216	124.144	22	8 52 09.475	120.451
23	7 16 24.360	124.064	23	8 54 09.926	120.387
November 9			November 11		
0	7 18 28.424	123.986	0	8 56 10.313	120.326
1	7 20 32.410	123.907	1	8 58 10.639	120.264
2	7 22 36.317	123.827	2	9 00 10.903	120.206
3	7 24 40.144	123.747	3	9 02 11.109	120.146
4	7 26 43.891	123.667	4	9 04 11.255	120.090
5	7 28 47.558	123.586	5	9 06 11.345	120.034
6	7 30 51.144	123.505	6	9 08 11.379	119.979
7	7 32 54.649	123.425	7	9 10 11.358	119.925
8	7 34 58.074	123.344	8	9 12 11.283	119.874
9	7 37 01.418	123.262	9	9 14 11.157	119.822
10	7 39 04.680	123.181	10	9 16 10.979	119.774
11	7 41 07.861	123.099	11	9 18 10.753	119.725
12	7 43 10.960	123.018	12	9 20 10.478	119.679
13	7 45 13.978	122.937	13	9 22 10.157	119.634
14	7 47 16.915	122.855	14	9 24 09.791	119.591
15	7 49 19.770	122.774	15	9 26 09.382	119.548
16	7 51 22.544	122.692	16	9 28 08.930	119.508
17	7 53 25.236	122.612	17	9 30 08.438	119.469
18	7 55 27.848	122.530	18	9 32 07.907	119.432
19	7 57 30.378	122.449	19	9 34 07.339	119.396
20	7 59 32.827	122.369	20	9 36 06.735	119.362
21	8 01 35.196	122.288	21	9 38 06.097	119.330
22	8 03 37.484	122.209	22	9 40 05.427	119.299
23	8 05 39.693	122.128	23	9 42 04.726	119.270
24	8 07 41.821		24	9 44 03.996	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
November 12									November 14								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	9	44	03.996	119.243	+11	53	17.45	-453.02	0	11	19	34.677	120.441	+4	54	17.76	-586.07
1	9	46	03.239	119.218	11	45	44.43	456.45	1	11	21	35.118	120.525	4	44	31.69	588.08
2	9	48	02.457	119.194	11	38	07.98	459.83	2	11	23	35.643	120.612	4	34	43.61	590.05
3	9	50	01.651	119.173	11	30	28.15	463.20	3	11	25	36.255	120.703	4	24	53.56	591.98
4	9	52	00.824	119.153	11	22	44.95	466.55	4	11	27	36.958	120.795	4	15	01.58	593.88
5	9	53	59.977	119.134	11	14	58.40	469.87	5	11	29	37.753	120.890	4	05	07.70	595.74
6	9	55	59.111	119.119	11	07	08.53	473.16	6	11	31	38.643	120.989	3	55	11.96	597.57
7	9	57	58.230	119.104	10	59	15.37	476.42	7	11	33	39.632	121.090	3	45	14.39	599.35
8	9	59	57.334	119.093	10	51	18.95	479.67	8	11	35	40.722	121.193	3	35	15.04	601.10
9	10	01	56.427	119.082	10	43	19.28	482.88	9	11	37	41.915	121.299	3	25	13.94	602.80
10	10	03	55.509	119.073	10	35	16.40	486.07	10	11	39	43.214	121.409	3	15	11.14	604.48
11	10	05	54.582	119.068	10	27	10.33	489.24	11	11	41	44.623	121.521	3	05	06.66	606.10
12	10	07	53.650	119.063	10	19	01.09	492.38	12	11	43	46.144	121.635	2	55	00.56	607.69
13	10	09	52.713	119.062	10	10	48.71	495.48	13	11	45	47.779	121.753	2	44	52.87	609.24
14	10	11	51.775	119.061	10	02	33.23	498.57	14	11	47	49.532	121.873	2	34	43.63	610.75
15	10	13	50.836	119.063	9	54	14.66	501.63	15	11	49	51.405	121.996	2	24	32.88	612.22
16	10	15	49.899	119.068	9	45	53.03	504.66	16	11	51	53.401	122.122	2	14	20.66	613.64
17	10	17	48.967	119.074	9	37	28.37	507.67	17	11	53	55.523	122.250	2	04	07.02	615.02
18	10	19	48.041	119.083	9	29	00.70	510.64	18	11	55	57.773	122.382	1	53	52.00	616.37
19	10	21	47.124	119.093	9	20	30.06	513.58	19	11	58	00.155	122.516	1	43	35.63	617.66
20	10	23	46.217	119.106	9	11	56.48	516.51	20	12	00	02.671	122.653	1	33	17.97	618.91
21	10	25	45.323	119.121	9	03	19.97	519.41	21	12	02	05.324	122.793	1	22	59.06	620.12
22	10	27	44.444	119.139	8	54	40.56	522.26	22	12	04	08.117	122.936	1	12	38.94	621.29
23	10	29	43.583	119.159	+8	45	58.30	-525.11	23	12	06	11.053	123.081	+1	02	17.65	-622.41
November 13									November 15								
0	10	31	42.742	119.180	+8	37	13.19	-527.91	0	12	08	14.134	123.229	+0	51	55.24	-623.48
1	10	33	41.922	119.205	8	28	25.28	530.69	1	12	10	17.363	123.380	0	41	31.76	624.52
2	10	35	41.127	119.232	8	19	34.59	533.44	2	12	12	20.743	123.534	0	31	07.24	625.49
3	10	37	40.359	119.260	8	10	41.15	536.16	3	12	14	24.277	123.691	0	20	41.75	626.43
4	10	39	39.619	119.292	8	01	44.99	538.85	4	12	16	27.968	123.850	+0	10	15.32	627.31
5	10	41	38.911	119.325	7	52	46.14	541.52	5	12	18	31.818	124.012	-0	00	11.99	628.16
6	10	43	38.236	119.362	7	43	44.62	544.14	6	12	20	35.830	124.178	0	10	40.15	628.95
7	10	45	37.598	119.400	7	34	40.48	546.75	7	12	22	40.008	124.345	0	21	09.10	629.69
8	10	47	36.998	119.441	7	25	33.73	549.31	8	12	24	44.353	124.516	0	31	38.79	630.38
9	10	49	36.439	119.485	7	16	24.42	551.86	9	12	26	48.869	124.689	0	42	09.17	631.02
10	10	51	35.924	119.530	7	07	12.56	554.37	10	12	28	53.558	124.865	0	52	40.19	631.62
11	10	53	35.454	119.579	6	57	58.19	556.84	11	12	30	58.423	125.045	1	03	11.81	632.16
12	10	55	35.033	119.630	6	48	41.35	559.29	12	12	33	03.468	125.226	1	13	43.97	632.64
13	10	57	34.663	119.683	6	39	22.06	561.71	13	12	35	08.694	125.410	1	24	16.61	633.09
14	10	59	34.346	119.739	6	30	00.35	564.08	14	12	37	14.104	125.598	1	34	49.70	633.46
15	11	01	34.085	119.797	6	20	36.27	566.44	15	12	39	19.702	125.788	1	45	23.16	633.80
16	11	03	33.882	119.859	6	11	09.83	568.75	16	12	41	25.490	125.980	1	55	56.96	634.08
17	11	05	33.741	119.922	6	01	41.08	571.04	17	12	43	31.470	126.176	2	06	31.04	634.30
18	11	07	33.663	119.988	5	52	10.04	573.28	18	12	45	37.646	126.373	2	17	05.34	634.46
19	11	09	33.651	120.058	5	42	36.76	575.51	19	12	47	44.019	126.575	2	27	39.80	634.58
20	11	11	33.709	120.128	5	33	01.25	577.68	20	12	49	50.594	126.778	2	38	14.38	634.64
21	11	13	33.837	120.203	5	23	23.57	579.84	21	12	51	57.372	126.984	2	48	49.02	634.63
22	11	15	34.040	120.279	5	13	43.73	581.95	22	12	54	04.356	127.192	2	59	23.65	634.58
23	11	17	34.319	120.358	5	04	01.78	-584.02	23	12	56	11.548	127.404	3	09	58.23	-634.46
24	11	19	34.677		+4	54	17.76		24	12	58	18.952		-3	20	32.69	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 16							November 18						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	12	58	18.952	127.618	3	20 32.69	0	14	45	06.802	140.285	-11	24 42.67
1	13	00	26.570	127.834	3	31 06.98	1	14	47	27.087	140.579	11	33 49.62
2	13	02	34.404	128.054	3	41 41.03	2	14	49	47.666	140.872	11	42 52.91
3	13	04	42.458	128.274	3	52 14.80	3	14	52	08.538	141.166	11	51 52.49
4	13	06	50.732	128.499	4	02 48.21	4	14	54	29.704	141.459	12	00 48.25
5	13	08	59.231	128.726	4	13 21.21	5	14	56	51.163	141.751	12	09 40.13
6	13	11	07.957	128.955	4	23 53.73	6	14	59	12.914	142.045	12	18 28.04
7	13	13	16.912	129.186	4	34 25.72	7	15	01	34.959	142.337	12	27 11.90
8	13	15	26.098	129.420	4	44 57.12	8	15	03	57.296	142.630	12	35 51.64
9	13	17	35.518	129.656	4	55 27.85	9	15	06	19.926	142.920	12	44 27.18
10	13	19	45.174	129.895	5	05 57.86	10	15	08	42.846	143.211	12	52 58.43
11	13	21	55.069	130.135	5	16 27.08	11	15	11	06.057	143.501	13	01 25.31
12	13	24	05.204	130.379	5	26 55.45	12	15	13	29.558	143.790	13	09 47.75
13	13	26	15.583	130.625	5	37 22.90	13	15	15	53.348	144.079	13	18 05.66
14	13	28	26.208	130.872	5	47 49.36	14	15	18	17.427	144.365	13	26 18.98
15	13	30	37.080	131.122	5	58 14.78	15	15	20	41.792	144.651	13	34 27.61
16	13	32	48.202	131.374	6	08 39.09	16	15	23	06.443	144.935	13	42 31.48
17	13	34	59.576	131.629	6	19 02.21	17	15	25	31.378	145.219	13	50 30.51
18	13	37	11.205	131.884	6	29 24.07	18	15	27	56.597	145.501	13	58 24.63
19	13	39	23.089	132.143	6	39 44.62	19	15	30	22.098	145.780	14	06 13.75
20	13	41	35.232	132.404	6	50 03.79	20	15	32	47.878	146.059	14	13 57.79
21	13	43	47.636	132.665	7	00 21.49	21	15	35	13.937	146.336	14	21 36.69
22	13	46	00.301	132.930	7	10 37.67	22	15	37	40.273	146.611	14	29 10.36
23	13	48	13.231	133.195	7	20 52.25	23	15	40	06.884	146.883	14	36 38.72
						-612.91							-442.99
November 17							November 19						
0	13	50	26.426	133.464	7	31 05.16	0	15	42	33.767	147.154	-14	44 01.71
1	13	52	39.890	133.733	7	41 16.33	1	15	45	00.921	147.422	14	51 19.24
2	13	54	53.623	134.004	7	51 25.69	2	15	47	28.343	147.688	14	58 31.25
3	13	57	07.627	134.277	8	01 33.17	3	15	49	56.031	147.952	15	05 37.64
4	13	59	21.904	134.552	8	11 38.69	4	15	52	23.983	148.213	15	12 38.36
5	14	01	36.456	134.827	8	21 42.18	5	15	54	52.196	148.471	15	19 33.33
6	14	03	51.283	135.106	8	31 43.57	6	15	57	20.667	148.727	15	26 22.48
7	14	06	06.389	135.384	8	41 42.78	7	15	59	49.394	148.980	15	33 05.73
8	14	08	21.773	135.665	8	51 39.74	8	16	02	18.374	149.229	15	39 43.01
9	14	10	37.438	135.947	9	01 34.37	9	16	04	47.603	149.476	15	46 14.25
10	14	12	53.855	136.229	9	11 26.60	10	16	07	17.079	149.720	15	52 39.38
11	14	15	09.614	136.514	9	21 16.35	11	16	09	46.799	149.960	15	58 58.34
12	14	17	26.128	136.799	9	31 03.55	12	16	12	16.759	150.196	16	05 11.06
13	14	19	42.927	137.086	9	40 48.12	13	16	14	46.955	150.430	16	11 17.46
14	14	22	00.013	137.373	9	50 29.99	14	16	17	17.385	150.659	16	17 17.48
15	14	24	17.386	137.661	10	00 09.07	15	16	19	48.044	150.885	16	23 11.06
16	14	26	35.047	137.950	10	09 45.29	16	16	22	18.929	151.107	16	28 58.13
17	14	28	52.997	138.241	10	19 18.57	17	16	24	50.036	151.324	16	34 38.63
18	14	31	11.238	138.530	10	28 48.83	18	16	27	21.360	151.539	16	40 12.49
19	14	33	29.768	138.823	10	38 16.00	19	16	29	52.899	151.749	16	45 39.65
20	14	35	48.591	139.114	10	47 39.99	20	16	32	24.648	151.954	16	51 00.06
21	14	38	07.705	139.406	10	57 00.74	21	16	34	56.602	152.156	16	56 13.65
22	14	40	27.111	139.699	11	06 18.15	22	16	37	28.758	152.352	17	01 20.37
23	14	42	46.810	139.992	11	15 32.15	23	16	40	01.110	152.545	17	06 20.16
24	14	45	06.802		11	24 42.67	24	16	42	33.655		17	11 12.95
						-550.52							-292.79

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
November 20									November 22								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	16	42	33.655	152.732	-17	11	12.95	-285.76	0	18	46	34.973	155.070	-18	36	07.05	+87.81
1	16	45	06.387	152.915	17	15	58.71	278.66	1	18	49	10.043	154.970	18	34	39.24	95.69
2	16	47	39.302	153.093	17	20	37.37	271.51	2	18	51	45.013	154.865	18	33	03.55	103.52
3	16	50	12.395	153.266	17	25	08.88	264.31	3	18	54	19.878	154.755	18	31	20.03	111.34
4	16	52	45.661	153.435	17	29	33.19	257.06	4	18	56	54.633	154.639	18	29	28.69	119.19
5	16	55	19.096	153.597	17	33	50.25	249.77	5	18	59	29.272	154.517	18	27	29.56	126.88
6	16	57	52.693	153.756	17	38	00.02	242.42	6	19	02	03.789	154.390	18	25	22.68	134.62
7	17	00	26.449	153.908	17	42	02.44	235.04	7	19	04	38.179	154.257	18	23	08.06	142.31
8	17	03	00.357	154.055	17	45	57.48	227.60	8	19	07	12.436	154.120	18	20	45.75	149.98
9	17	05	34.412	154.197	17	49	45.08	220.12	9	19	09	46.556	153.977	18	18	15.77	157.61
10	17	08	08.609	154.334	17	53	25.20	212.60	10	19	12	20.533	153.829	18	15	38.16	165.21
11	17	10	42.943	154.465	17	56	57.80	205.05	11	19	14	54.362	153.676	18	12	52.95	172.77
12	17	13	17.408	154.590	18	00	22.85	197.45	12	19	17	28.038	153.518	18	10	00.18	180.30
13	17	15	51.998	154.710	18	03	40.30	189.82	13	19	20	01.556	153.355	18	06	59.88	187.77
14	17	18	26.708	154.824	18	06	50.12	182.16	14	19	22	34.911	153.188	18	03	52.11	195.22
15	17	21	01.532	154.932	18	09	52.28	174.45	15	19	25	08.099	153.016	18	00	36.89	202.62
16	17	23	36.464	155.035	18	12	46.73	166.71	16	19	27	41.115	152.839	17	57	14.27	209.97
17	17	26	11.499	155.131	18	15	33.44	158.96	17	19	30	13.954	152.657	17	53	44.30	217.29
18	17	28	46.630	155.221	18	18	12.40	151.16	18	19	32	46.611	152.473	17	50	07.01	224.56
19	17	31	21.851	155.306	18	20	43.56	143.34	19	19	35	19.084	152.282	17	46	22.45	231.78
20	17	33	57.157	155.385	18	23	06.90	135.50	20	19	37	51.366	152.088	17	42	30.67	238.96
21	17	36	32.542	155.456	18	25	22.40	127.62	21	19	40	23.454	151.890	17	38	31.71	246.08
22	17	39	07.998	155.524	18	27	30.02	119.74	22	19	42	55.344	151.688	17	34	25.63	253.16
23	17	41	43.522	155.583	-18	29	29.76	-111.82	23	19	45	27.032	151.483	-17	30	12.47	+260.19
November 21									November 23								
0	17	44	19.105	155.637	-18	31	21.58	-103.89	0	19	47	58.515	151.272	-17	25	52.28	+267.15
1	17	46	54.742	155.686	18	33	05.47	95.94	1	19	50	29.787	151.059	17	21	25.13	274.08
2	17	49	30.428	155.726	18	34	41.41	87.97	2	19	53	00.846	150.843	17	16	51.05	280.95
3	17	52	06.154	155.763	18	36	09.38	80.00	3	19	55	31.689	150.622	17	12	10.10	287.76
4	17	54	41.917	155.791	18	37	29.38	72.00	4	19	58	02.311	150.398	17	07	22.34	294.52
5	17	57	17.708	155.814	18	38	41.38	64.00	5	20	00	32.709	150.172	17	02	27.82	301.22
6	17	59	53.522	155.831	18	39	45.38	56.00	6	20	03	02.881	149.942	16	57	26.60	307.87
7	18	02	29.353	155.841	18	40	41.38	47.97	7	20	05	32.823	149.708	16	52	18.73	314.45
8	18	05	05.194	155.845	18	41	29.35	39.95	8	20	08	02.531	149.473	16	47	04.28	320.98
9	18	07	41.039	155.843	18	42	09.30	31.92	9	20	10	32.004	149.235	16	41	43.30	327.45
10	18	10	16.882	155.834	18	42	41.22	23.89	10	20	13	01.239	148.993	16	36	15.85	333.86
11	18	12	52.716	155.820	18	43	05.11	15.86	11	20	15	30.232	148.749	16	30	41.99	340.21
12	18	15	28.536	155.799	18	43	20.97	7.84	12	20	17	58.981	148.503	16	25	01.78	346.49
13	18	18	04.335	155.771	18	43	28.81	+0.20	13	20	20	27.484	148.255	16	19	15.29	352.72
14	18	20	40.106	155.738	18	43	28.61	8.21	14	20	22	55.739	148.003	16	13	22.57	358.88
15	18	23	15.844	155.698	18	43	20.40	16.23	15	20	25	23.742	147.751	16	07	23.69	364.98
16	18	25	51.542	155.653	18	43	04.17	24.24	16	20	27	51.493	147.496	16	01	18.71	371.01
17	18	28	27.195	155.601	18	42	39.93	32.24	17	20	30	18.989	147.239	15	55	07.70	376.99
18	18	31	02.796	155.542	18	42	07.69	40.22	18	20	32	46.228	146.981	15	48	50.71	382.89
19	18	33	38.338	155.479	18	41	27.47	48.20	19	20	35	13.209	146.720	15	42	27.82	388.74
20	18	36	13.817	155.409	18	40	39.27	56.15	20	20	37	39.929	146.459	15	35	59.08	394.51
21	18	38	49.226	155.333	18	39	43.12	64.11	21	20	40	06.388	146.195	15	29	24.57	400.21
22	18	41	24.559	155.251	18	38	39.01	72.02	22	20	42	32.583	145.931	15	22	44.36	405.86
23	18	43	59.810	155.163	18	37	26.99	79.94	23	20	44	58.514	145.665	15	15	58.50	+411.44
24	18	46	34.973		-18	36	07.05		24	20	47	24.179		-15	09	07.06	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination						
November 24									November 26											
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"			
0	20	47	24	179	145°398	-15	09	07.06	+416.95	0	22	38	42	618	132°997	-8	13	10.03	+600.41	
1	20	49	49	577	145°130	15	02	10.11	422.38	1	22	40	55	615	132°776	8	03	09.62	602.58	
2	20	52	14	707	144°861	14	55	07.73	427.76	2	22	43	08	391	132°558	7	53	07.04	604.69	
3	20	54	39	568	144°592	14	47	59.97	433.07	3	22	45	20	949	132°342	7	43	02.35	606.73	
4	20	57	04	160	144°321	14	40	46.90	438.30	4	22	47	33	291	132°128	7	32	55.62	608.77	
5	20	59	28	481	144°049	14	33	28.60	443.47	5	22	49	45	419	131°917	7	22	46.91	610.62	
6	21	01	52	530	143°779	14	26	05.13	448.57	6	22	51	57	336	131°708	7	12	36.29	612.49	
7	21	04	16	309	143°506	14	18	36.56	453.61	7	22	54	09	044	131°502	7	02	23.80	614.27	
8	21	06	39	815	143°234	14	11	02.95	458.56	8	22	56	20	546	131°298	6	52	09.53	616.00	
9	21	09	03	049	142°961	14	03	24.39	463.45	9	22	58	31	844	131°098	6	41	53.53	617.68	
10	21	11	26	010	142°688	13	55	40.94	468.28	10	23	00	42	942	130°899	6	31	35.85	619.27	
11	21	13	48	698	142°416	13	47	52.66	473.03	11	23	02	53	841	130°703	6	21	16.58	620.83	
12	21	16	11	114	142°143	13	39	59.63	477.72	12	23	05	04	544	130°510	6	10	55.75	622.31	
13	21	18	33	257	141°870	13	32	01.91	482.33	13	23	07	15	054	130°320	6	00	33.44	623.73	
14	21	20	55	127	141°598	13	23	59.58	486.87	14	23	09	25	374	130°132	5	50	09.71	625.10	
15	21	23	16	725	141°326	13	15	52.71	491.35	15	23	11	35	506	129°946	5	39	44.61	626.40	
16	21	25	38	051	141°054	13	07	41.36	495.75	16	23	13	45	452	129°765	5	29	18.21	627.64	
17	21	27	59	105	140°783	12	59	25.61	500.08	17	23	15	55	217	129°585	5	18	50.57	628.83	
18	21	30	19	888	140°512	12	51	05.53	504.36	18	23	18	04	802	129°408	5	08	21.74	629.95	
19	21	32	40	400	140°242	12	42	41.17	508.54	19	23	20	14	210	129°234	4	57	51.79	631.02	
20	21	35	00	642	139°973	12	34	12.63	512.67	20	23	22	23	444	129°062	4	47	20.77	632.03	
21	21	37	20	615	139°704	12	25	39.96	516.73	21	23	24	32	506	128°894	4	36	48.74	632.97	
22	21	39	40	319	139°437	12	17	03.23	520.72	22	23	26	41	400	128°729	4	26	15.77	633.87	
23	21	41	59	756	139°170	-12	08	22.51	+524.63	23	23	28	50	129	128°565	-4	15	41.90	+634.71	
November 25									November 27											
0	21	44	18	926	138°904	-11	59	37.88	+528.47	0	23	30	58	694	128°406	-4	05	07.19	+635.47	
1	21	46	37	830	138°640	11	50	49.41	532.26	1	23	33	07	100	128°248	3	54	31.72	636.20	
2	21	48	56	470	138°376	11	41	57.15	535.96	2	23	35	15	348	128°094	3	43	55.52	636.87	
3	21	51	14	846	138°114	11	33	01.19	539.60	3	23	37	23	442	127°942	3	33	18.65	637.46	
4	21	53	32	960	137°853	11	24	01.59	543.18	4	23	39	31	384	127°793	3	22	41.19	638.02	
5	21	55	50	813	137°594	11	14	58.41	546.67	5	23	41	39	177	127°648	3	12	03.17	638.51	
6	21	58	08	407	137°335	11	05	51.74	550.11	6	23	43	46	825	127°504	3	01	24.66	638.95	
7	22	00	25	742	137°079	10	56	41.63	553.47	7	23	45	54	329	127°365	2	50	45.71	639.33	
8	22	02	42	821	136°824	10	47	28.16	556.77	8	23	48	01	694	127°226	2	40	06.38	639.66	
9	22	04	59	645	136°570	10	38	11.39	560.00	9	23	50	08	920	127°093	2	29	26.72	639.94	
10	22	07	16	215	136°319	10	28	51.39	563.16	10	23	52	16	013	126°961	2	18	46.78	640.15	
11	22	09	32	534	136°068	10	19	28.23	566.25	11	23	54	22	974	126°832	2	08	06.63	640.32	
12	22	11	48	602	135°821	10	10	01.98	569.28	12	23	56	29	806	126°705	1	57	26.31	640.42	
13	22	14	04	423	135°574	10	00	32.70	572.24	13	23	58	36	511	126°583	1	46	45.89	640.48	
14	22	16	19	997	135°329	9	51	00.46	575.12	14	0	00	43	094	126°463	1	36	05.41	640.49	
15	22	18	35	326	135°086	9	41	25.34	577.95	15	0	02	49	557	126°345	1	25	24.92	640.43	
16	22	20	50	412	134°846	9	31	47.39	580.71	16	0	04	55	902	126°231	1	14	44.49	640.33	
17	22	23	05	258	134°608	9	22	06.68	583.40	17	0	07	02	133	126°118	1	04	04.16	640.18	
18	22	25	19	866	134°371	9	12	23.28	586.03	18	0	09	08	251	126°010	0	53	23.98	639.96	
19	22	27	34	237	134°136	9	02	37.25	588.59	19	0	11	14	261	125°904	0	42	44.02	639.71	
20	22	29	48	373	133°904	8	52	48.66	591.08	20	0	13	20	165	125°800	0	32	04.31	639.39	
21	22	32	02	277	133°674	8	42	57.58	593.51	21	0	15	25	965	125°700	0	21	24.92	639.03	
22	22	34	15	951	133°446	8	33	04.07	595.87	22	0	17	31	665	125°602	0	10	45.89	638.61	
23	22	36	29	397	133°221	-8	23	08.20	+598.17	23	0	19	37	267	125°507	-	0	00	07.28	+638.14
24	22	38	42	618		-8	13	10.03		24	0	21	42	774		+	0	10	30.86	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 28							November 30						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	0	21	42.774	125.414	+	0 10 30.86	0	2	01	05.521	123.871	+	8 16 01.08
1	0	23	48.188	125.325		0 21 08.48	1	2	03	09.392	123.889		8 25 17.96
2	0	25	53.513	125.239		0 31 45.54	2	2	05	13.281	123.908		8 34 32.07
3	0	27	58.752	125.154		0 42 21.97	3	2	07	17.189	123.929		8 43 43.38
4	0	30	03.906	125.073		0 52 57.73	4	2	09	21.118	123.951		8 52 51.84
5	0	32	08.979	124.994		1 03 32.77	5	2	11	25.069	123.975		9 01 57.41
6	0	34	13.973	124.919		1 14 07.05	6	2	13	29.044	124.000		9 11 00.06
7	0	36	18.892	124.845		1 24 40.50	7	2	15	33.044	124.026		9 19 59.74
8	0	38	23.737	124.774		1 35 13.08	8	2	17	37.070	124.054		9 28 56.42
9	0	40	28.511	124.706		1 45 44.74	9	2	19	41.124	124.083		9 37 50.05
10	0	42	33.217	124.641		1 56 15.44	10	2	21	45.207	124.114		9 46 40.59
11	0	44	37.858	124.579		2 06 45.11	11	2	23	49.321	124.145		9 55 28.01
12	0	46	42.437	124.517		2 17 13.73	12	2	25	53.466	124.178		10 04 12.27
13	0	48	46.954	124.461		2 27 41.23	13	2	27	57.644	124.211		10 12 53.32
14	0	50	51.415	124.405		2 38 07.56	14	2	30	01.855	124.247		10 21 31.13
15	0	52	55.820	124.352		2 48 32.69	15	2	32	06.102	124.282		10 30 05.66
16	0	55	00.172	124.303		2 58 56.56	16	2	34	10.384	124.319		10 38 36.88
17	0	57	04.475	124.255		3 09 19.12	17	2	36	14.703	124.358		10 47 04.74
18	0	59	08.730	124.209		3 19 40.34	18	2	38	19.061	124.396		10 55 29.21
19	1	01	12.939	124.167		3 30 00.15	19	2	40	23.457	124.436		11 03 50.25
20	1	03	17.106	124.126		3 40 18.52	20	2	42	27.893	124.476		11 12 07.82
21	1	05	21.232	124.089		3 50 35.39	21	2	44	32.369	124.518		11 20 21.89
22	1	07	25.321	124.053		4 00 50.72	22	2	46	36.887	124.560		11 28 32.42
23	1	09	29.374	124.020	+	4 11 04.47	23	2	48	41.447	124.604	+	11 36 39.37
						+612.11							+483.34
November 29							December 1						
0	1	11	33.394	123.989	+	4 21 16.58	0	2	50	46.051	124.647	+	11 44 42.71
1	1	13	37.383	123.960		4 31 27.02	1	2	52	50.698	124.691		11 52 42.40
2	1	15	41.343	123.934		4 41 35.73	2	2	54	55.389	124.736		12 00 38.41
3	1	17	45.277	123.909		4 51 42.68	3	2	57	00.125	124.782		12 08 30.70
4	1	19	49.186	123.888		5 01 47.81	4	2	59	04.907	124.827		12 16 19.23
5	1	21	53.074	123.868		5 11 51.07	5	3	01	09.734	124.875		12 24 03.98
6	1	23	56.942	123.851		5 21 52.44	6	3	03	14.609	124.921		12 31 44.90
7	1	26	00.793	123.835		5 31 51.85	7	3	05	19.530	124.969		12 39 21.96
8	1	28	04.628	123.822		5 41 49.27	8	3	07	24.499	125.016		12 46 55.14
9	1	30	08.450	123.810		5 51 44.65	9	3	09	29.515	125.065		12 54 24.38
10	1	32	12.260	123.802		6 01 37.95	10	3	11	34.580	125.113		13 01 49.67
11	1	34	16.062	123.794		6 11 29.12	11	3	13	39.693	125.162		13 09 10.97
12	1	36	19.856	123.789		6 21 18.12	12	3	15	44.855	125.210		13 16 28.25
13	1	38	23.645	123.786		6 31 04.90	13	3	17	50.065	125.260		13 23 41.47
14	1	40	27.431	123.784		6 40 49.43	14	3	19	55.325	125.309		13 30 50.60
15	1	42	31.215	123.786		6 50 31.66	15	3	22	00.634	125.358		13 37 55.61
16	1	44	35.001	123.787		7 00 11.54	16	3	24	05.992	125.408		13 44 56.47
17	1	46	38.788	123.792		7 09 49.03	17	3	26	11.400	125.456		13 51 53.15
18	1	48	42.580	123.798		7 19 24.09	18	3	28	16.856	125.506		13 58 45.61
19	1	50	46.378	123.806		7 28 56.68	19	3	30	22.362	125.556		14 05 33.83
20	1	52	50.184	123.816		7 38 26.76	20	3	32	27.918	125.604		14 12 17.78
21	1	54	54.000	123.827		7 47 54.28	21	3	34	33.522	125.653		14 18 57.43
22	1	56	57.827	123.840		7 57 19.20	22	3	36	39.175	125.702		14 25 32.74
23	1	59	01.667	123.854		8 06 41.48	23	3	38	44.877	125.751		14 32 03.69
24	2	01	05.521	123.854	+	8 16 01.08	24	3	40	50.628	125.751	+	14 38 30.25
						+559.60							+386.56

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
December 2									December 4								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	3	40	50.628	125.799	+14	38	30.25	+382.14	0	5	22	10.026	127.107	+18	13	59.24	+144.76
1	3	42	56.427	125.847	14	44	52.39	377.70	1	5	24	17.133	127.102	18	16	24.00	139.46
2	3	45	02.274	125.894	14	51	10.09	373.22	2	5	26	24.235	127.096	18	18	43.46	134.17
3	3	47	08.168	125.941	14	57	23.31	368.72	3	5	28	31.331	127.086	18	20	57.63	128.87
4	3	49	14.109	125.989	15	03	32.03	364.19	4	5	30	38.417	127.077	18	23	06.50	123.57
5	3	51	20.098	126.034	15	09	36.22	359.64	5	5	32	45.494	127.064	18	25	10.07	118.25
6	3	53	26.132	126.081	15	15	35.86	355.05	6	5	34	52.558	127.051	18	27	08.32	112.94
7	3	55	32.213	126.125	15	21	30.91	350.46	7	5	36	59.609	127.035	18	29	01.26	107.62
8	3	57	38.338	126.171	15	27	21.37	345.81	8	5	39	06.644	127.019	18	30	48.88	102.29
9	3	59	44.509	126.214	15	33	07.18	341.17	9	5	41	13.663	127.000	18	32	31.17	96.98
10	4	01	50.723	126.258	15	38	48.35	336.48	10	5	43	20.663	126.979	18	34	08.15	91.64
11	4	03	56.981	126.300	15	44	24.83	331.77	11	5	45	27.642	126.957	18	35	39.79	86.32
12	4	06	03.281	126.343	15	49	56.60	327.05	12	5	47	34.599	126.933	18	37	06.11	80.99
13	4	08	09.624	126.383	15	55	23.65	322.30	13	5	49	41.532	126.908	18	38	27.10	75.66
14	4	10	16.007	126.424	16	00	45.95	317.52	14	5	51	48.440	126.880	18	39	42.76	70.33
15	4	12	22.431	126.464	16	06	03.47	312.72	15	5	53	55.320	126.852	18	40	53.09	65.00
16	4	14	28.895	126.502	16	11	16.19	307.90	16	5	56	02.172	126.820	18	41	58.09	59.67
17	4	16	35.397	126.541	16	16	24.09	303.06	17	5	58	08.992	126.789	18	42	57.76	54.34
18	4	18	41.938	126.577	16	21	27.15	298.20	18	6	00	15.781	126.754	18	43	52.10	49.02
19	4	20	48.515	126.613	16	26	25.35	293.32	19	6	02	22.535	126.718	18	44	41.12	43.69
20	4	22	55.128	126.648	16	31	18.67	288.41	20	6	04	29.253	126.681	18	45	24.81	38.36
21	4	25	01.776	126.681	16	36	07.08	283.49	21	6	06	35.934	126.642	18	46	03.17	33.05
22	4	27	08.457	126.715	16	40	50.57	278.55	22	6	08	42.576	126.601	18	46	36.22	27.73
23	4	29	15.172	126.746	+16	45	29.12	+273.59	23	6	10	49.177	126.558	+18	47	03.95	+22.43
December 3									December 5								
0	4	31	21.918	126.777	+16	50	02.71	+268.61	0	6	12	55.735	126.515	+18	47	26.38	+17.11
1	4	33	28.695	126.807	16	54	31.32	263.61	1	6	15	02.250	126.468	18	47	43.49	11.81
2	4	35	35.502	126.834	16	58	54.93	258.59	2	6	17	08.718	126.421	18	47	55.30	6.51
3	4	37	42.336	126.862	17	03	13.52	253.56	3	6	19	15.139	126.373	18	48	01.81	+1.23
4	4	39	49.198	126.887	17	07	27.08	248.51	4	6	21	21.512	126.321	18	48	03.04	-4.07
5	4	41	56.085	126.912	17	11	35.59	243.45	5	6	23	27.833	126.269	18	47	58.97	9.34
6	4	44	02.997	126.935	17	15	39.04	238.36	6	6	25	34.102	126.216	18	47	49.63	14.61
7	4	46	09.932	126.957	17	19	37.40	233.27	7	6	27	40.318	126.160	18	47	35.02	19.88
8	4	48	16.889	126.978	17	23	30.67	228.16	8	6	29	46.478	126.103	18	47	15.14	25.13
9	4	50	23.867	126.997	17	27	18.83	223.03	9	6	31	52.581	126.044	18	46	50.01	30.39
10	4	52	30.864	127.015	17	31	01.86	217.80	10	6	33	58.625	125.985	18	46	19.62	35.62
11	4	54	37.879	127.031	17	34	39.75	212.74	11	6	36	04.610	125.923	18	45	44.00	40.85
12	4	56	44.910	127.046	17	38	12.49	207.58	12	6	38	10.533	125.860	18	45	03.15	46.07
13	4	58	51.956	127.060	17	41	40.07	202.40	13	6	40	16.393	125.796	18	44	17.08	51.29
14	5	00	59.016	127.072	17	45	02.47	197.20	14	6	42	22.189	125.730	18	43	25.79	56.48
15	5	03	06.088	127.082	17	48	19.67	192.01	15	6	44	27.919	125.663	18	42	29.31	61.68
16	5	05	13.170	127.092	17	51	31.68	186.79	16	6	46	33.582	125.594	18	41	27.63	66.85
17	5	07	20.262	127.099	17	54	38.47	181.57	17	6	48	39.176	125.524	18	40	20.78	72.02
18	5	09	27.361	127.105	17	57	40.04	176.33	18	6	50	44.700	125.453	18	39	08.76	77.18
19	5	11	34.466	127.110	18	00	36.37	171.10	19	6	52	50.153	125.380	18	37	51.58	82.32
20	5	13	41.576	127.112	18	03	27.47	165.84	20	6	54	55.533	125.306	18	36	29.26	87.45
21	5	15	48.688	127.113	18	06	13.31	160.58	21	6	57	00.839	125.231	18	35	01.81	92.57
22	5	17	55.801	127.114	18	08	53.89	155.31	22	6	59	06.070	125.155	18	33	29.24	97.68
23	5	20	02.915	127.111	18	11	29.20	+150.04	23	7	01	11.225	125.077	18	31	51.56	-102.77
24	5	22	10.026		+18	13	59.24		24	7	03	16.302		+18	30	08.79	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 6							December 8						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	7 03	16.302	^s	+18 30	08.79	-107.84	0	8 41	32.892	^s	+15 33	48.95	-329.74
1	7 05	21.300	^s	18 28	20.95	112.91	1	8 43	33.363	^s	15 28	19.21	332.82
2	7 07	26.218	^s	18 26	28.04	117.95	2	8 45	33.739	^s	15 22	45.39	337.88
3	7 09	31.055	^s	18 24	30.09	122.99	3	8 47	34.021	^s	15 17	07.51	341.92
4	7 11	35.809	^s	18 22	27.10	128.00	4	8 49	34.210	^s	15 11	25.59	345.93
5	7 13	40.481	^s	18 20	19.10	133.01	5	8 51	34.306	^s	15 05	39.66	349.92
6	7 15	45.068	^s	18 18	06.09	138.00	6	8 53	34.310	^s	14 59	49.74	353.87
7	7 17	49.569	^s	18 15	48.09	142.96	7	8 55	34.222	^s	14 53	55.87	357.81
8	7 19	53.985	^s	18 13	25.13	147.92	8	8 57	34.044	^s	14 47	58.06	361.73
9	7 21	58.313	^s	18 10	57.21	152.86	9	8 59	33.777	^s	14 41	56.33	365.60
10	7 24	02.553	^s	18 08	24.35	157.77	10	9 01	33.420	^s	14 35	50.73	369.47
11	7 26	06.704	^s	18 05	46.58	162.68	11	9 03	32.976	^s	14 29	41.26	373.31
12	7 28	10.765	^s	18 03	03.90	167.57	12	9 05	32.445	^s	14 23	27.95	377.11
13	7 30	14.735	^s	18 00	16.33	172.43	13	9 07	31.829	^s	14 17	10.84	380.90
14	7 32	18.614	^s	17 57	23.90	177.27	14	9 09	31.127	^s	14 10	49.94	384.66
15	7 34	22.400	^s	17 54	26.63	182.11	15	9 11	30.342	^s	14 04	25.28	388.40
16	7 36	26.094	^s	17 51	24.52	186.92	16	9 13	29.474	^s	13 57	56.88	392.10
17	7 38	29.694	^s	17 48	17.60	191.72	17	9 15	28.524	^s	13 51	24.78	395.78
18	7 40	33.199	^s	17 45	05.88	196.48	18	9 17	27.495	^s	13 44	49.00	399.45
19	7 42	36.610	^s	17 41	49.40	201.24	19	9 19	26.386	^s	13 38	09.55	403.07
20	7 44	39.925	^s	17 38	28.16	205.97	20	9 21	25.199	^s	13 31	26.48	406.69
21	7 46	43.145	^s	17 35	02.19	210.69	21	9 23	23.936	^s	13 24	39.79	410.26
22	7 48	46.268	^s	17 31	31.50	215.38	22	9 25	22.597	^s	13 17	49.53	413.81
23	7 50	49.294	^s	+17 27	56.12	-220.06	23	9 27	21.185	^s	+13 10	55.72	-417.35
December 7							December 9						
0	7 52	52.223	^s	+17 24	16.06	-224.71	0	9 29	19.699	^s	+13 03	58.37	-420.85
1	7 54	55.054	^s	17 20	31.35	229.34	1	9 31	18.143	^s	12 56	57.52	424.32
2	7 56	57.787	^s	17 16	42.01	233.95	2	9 33	16.518	^s	12 49	53.20	427.78
3	7 59	00.421	^s	17 12	48.06	238.54	3	9 35	14.824	^s	12 42	45.42	431.20
4	8 01	02.957	^s	17 08	49.52	243.11	4	9 37	13.063	^s	12 35	34.22	434.59
5	8 03	05.394	^s	17 04	46.41	247.65	5	9 39	11.237	^s	12 28	19.63	437.97
6	8 05	07.732	^s	17 00	38.76	252.19	6	9 41	09.348	^s	12 21	01.66	441.32
7	8 07	09.971	^s	16 56	26.57	256.68	7	9 43	07.397	^s	12 13	40.34	444.63
8	8 09	12.111	^s	16 52	09.89	261.17	8	9 45	05.386	^s	12 06	15.71	447.93
9	8 11	14.151	^s	16 47	48.72	265.63	9	9 47	03.316	^s	11 58	47.78	451.20
10	8 13	16.092	^s	16 43	23.09	270.06	10	9 49	01.190	^s	11 51	16.58	454.44
11	8 15	17.933	^s	16 38	53.03	274.47	11	9 50	59.008	^s	11 43	42.14	457.65
12	8 17	19.675	^s	16 34	18.56	278.87	12	9 52	56.774	^s	11 36	04.49	460.83
13	8 19	21.317	^s	16 29	39.69	283.24	13	9 54	54.487	^s	11 28	23.66	464.00
14	8 21	22.861	^s	16 24	56.45	287.58	14	9 56	52.152	^s	11 20	39.66	467.13
15	8 23	24.305	^s	16 20	08.87	291.90	15	9 58	49.768	^s	11 12	52.53	470.24
16	8 25	25.650	^s	16 15	16.97	296.21	16	10 00	47.339	^s	11 05	02.29	473.32
17	8 27	26.897	^s	16 10	20.76	300.48	17	10 02	44.865	^s	10 57	08.97	476.38
18	8 29	28.046	^s	16 05	20.28	304.73	18	10 04	42.350	^s	10 49	12.59	479.40
19	8 31	29.096	^s	16 00	15.55	308.96	19	10 06	39.795	^s	10 41	13.19	482.40
20	8 33	30.049	^s	15 55	06.59	313.16	20	10 08	37.202	^s	10 33	10.79	485.37
21	8 35	30.905	^s	15 49	53.43	317.34	21	10 10	34.573	^s	10 25	05.42	488.31
22	8 37	31.663	^s	15 44	36.09	321.50	22	10 12	31.910	^s	10 16	57.11	491.24
23	8 39	32.325	^s	15 39	14.59	325.64	23	10 14	29.216	^s	10 08	45.87	494.13
24	8 41	32.892	^s	+15 33	48.95	-329.74	24	10 16	26.492	^s	+10 00	31.74	-420.85

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 10			December 12		
h	h m s	° ' " "	h	h m s	° ' " "
0	10 16 26.492 ^s	+10 00 31.74 ["]	0	11 50 29.233 ^s	+ 2 37 53.71 ["]
1	10 18 23.741 ^s	9 52 14.75 ["]	1	11 52 28.191 ^s	2 27 53.68 ["]
2	10 20 20.965 ^s	9 43 54.93 ["]	2	11 54 27.256 ^s	2 17 52.29 ["]
3	10 22 18.165 ^s	9 35 32.29 ["]	3	11 56 26.430 ^s	2 07 49.59 ["]
4	10 24 15.345 ^s	9 27 06.87 ["]	4	11 58 25.718 ^s	1 57 45.59 ["]
5	10 26 12.507 ^s	9 18 38.70 ["]	5	12 00 25.123 ^s	1 47 40.35 ["]
6	10 28 09.652 ^s	9 10 07.81 ["]	6	12 02 24.647 ^s	1 37 33.90 ["]
7	10 30 06.784 ^s	9 01 34.21 ["]	7	12 04 24.294 ^s	1 27 26.28 ["]
8	10 32 03.904 ^s	8 52 57.95 ["]	8	12 06 24.067 ^s	1 17 17.52 ["]
9	10 34 01.015 ^s	8 44 19.04 ["]	9	12 08 23.970 ^s	1 07 07.67 ["]
10	10 35 58.120 ^s	8 35 37.52 ["]	10	12 10 24.005 ^s	0 56 56.75 ["]
11	10 37 55.220 ^s	8 26 53.41 ["]	11	12 12 24.177 ^s	0 46 44.82 ["]
12	10 39 52.319 ^s	8 18 06.75 ["]	12	12 14 24.487 ^s	0 36 31.91 ["]
13	10 41 49.418 ^s	8 09 17.55 ["]	13	12 16 24.940 ^s	0 26 18.06 ["]
14	10 43 46.520 ^s	8 00 25.86 ["]	14	12 18 25.538 ^s	0 16 03.31 ["]
15	10 45 43.628 ^s	7 51 31.69 ["]	15	12 20 26.286 ^s	+ 0 05 47.71 ["]
16	10 47 40.745 ^s	7 42 35.08 ["]	16	12 22 27.186 ^s	- 0 04 28.72 ["]
17	10 49 37.872 ^s	7 33 36.06 ["]	17	12 24 28.241 ^s	0 14 45.92 ["]
18	10 51 35.013 ^s	7 24 34.65 ["]	18	12 26 29.456 ^s	0 25 03.85 ["]
19	10 53 32.170 ^s	7 15 30.88 ["]	19	12 28 30.832 ^s	0 35 22.47 ["]
20	10 55 29.345 ^s	7 06 24.79 ["]	20	12 30 32.375 ^s	0 45 41.74 ["]
21	10 57 26.542 ^s	6 57 16.40 ["]	21	12 32 34.086 ^s	0 56 01.62 ["]
22	10 59 23.763 ^s	6 48 05.74 ["]	22	12 34 35.969 ^s	1 06 22.06 ["]
23	11 01 21.011 ^s	+ 6 38 52.84 ["]	23	12 36 38.028 ^s	- 1 16 43.01 ["]
	117.277	-555.10		122.237	-621.43
December 11			December 13		
0	11 03 18.288 ^s	+ 6 29 37.74 ["]	0	12 38 40.265 ^s	- 1 27 04.44 ["]
1	11 05 15.598 ^s	6 20 20.45 ["]	1	12 40 42.685 ^s	1 37 26.29 ["]
2	11 07 12.942 ^s	6 11 01.02 ["]	2	12 42 45.290 ^s	1 47 48.52 ["]
3	11 09 10.325 ^s	6 01 39.47 ["]	3	12 44 48.084 ^s	1 58 11.09 ["]
4	11 11 07.748 ^s	5 52 15.83 ["]	4	12 46 51.070 ^s	2 08 33.95 ["]
5	11 13 05.214 ^s	5 42 50.14 ["]	5	12 48 54.252 ^s	2 18 57.05 ["]
6	11 15 02.727 ^s	5 33 22.42 ["]	6	12 50 57.632 ^s	2 29 20.34 ["]
7	11 17 00.289 ^s	5 23 52.71 ["]	7	12 53 01.214 ^s	2 39 43.78 ["]
8	11 18 57.903 ^s	5 14 21.03 ["]	8	12 55 05.002 ^s	2 50 07.31 ["]
9	11 20 55.572 ^s	5 04 47.43 ["]	9	12 57 08.998 ^s	3 00 30.89 ["]
10	11 22 53.299 ^s	4 55 11.92 ["]	10	12 59 13.206 ^s	3 10 54.47 ["]
11	11 24 51.086 ^s	4 45 34.55 ["]	11	13 01 17.629 ^s	3 21 18.00 ["]
12	11 26 48.938 ^s	4 35 55.34 ["]	12	13 03 22.270 ^s	3 31 41.42 ["]
13	11 28 46.856 ^s	4 26 14.33 ["]	13	13 05 27.133 ^s	3 42 04.69 ["]
14	11 30 44.844 ^s	4 16 31.54 ["]	14	13 07 32.221 ^s	3 52 27.75 ["]
15	11 32 42.905 ^s	4 06 47.02 ["]	15	13 09 37.538 ^s	4 02 50.55 ["]
16	11 34 41.042 ^s	3 57 00.80 ["]	16	13 11 43.085 ^s	4 13 13.04 ["]
17	11 36 39.257 ^s	3 47 12.90 ["]	17	13 13 48.868 ^s	4 23 35.17 ["]
18	11 38 37.555 ^s	3 37 23.37 ["]	18	13 15 54.888 ^s	4 33 56.87 ["]
19	11 40 35.937 ^s	3 27 32.23 ["]	19	13 18 01.148 ^s	4 44 18.10 ["]
20	11 42 34.408 ^s	3 17 39.53 ["]	20	13 20 07.654 ^s	4 54 38.79 ["]
21	11 44 32.970 ^s	3 07 45.29 ["]	21	13 22 14.406 ^s	5 04 58.90 ["]
22	11 46 31.626 ^s	2 57 49.55 ["]	22	13 24 21.408 ^s	5 15 18.37 ["]
23	11 48 30.379 ^s	2 47 52.34 ["]	23	13 26 28.665 ^s	5 25 37.13 ["]
24	11 50 29.233 ^s	+ 2 37 53.71 ["]	24	13 28 36.177 ^s	- 5 35 55.14 ["]
	118.854	-598.61		127.512	-618.01

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 14			December 16		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	13 28 36.177 ^s	- 5 35 55.14 ["]	0	15 16 29.631 ^s	-13 14 04.86 ["]
1	13 30 43.950 ^s	5 46 12.33 ["]	1	15 18 52.630 ^s	13 22 22.63 ["]
2	13 32 51.985 ^s	5 56 28.65 ["]	2	15 21 15.977 ^s	13 30 36.03 ["]
3	13 35 00.285 ^s	6 06 44.02 ["]	3	15 23 39.673 ^s	13 38 44.98 ["]
4	13 37 08.855 ^s	6 16 58.41 ["]	4	15 26 03.717 ^s	13 46 49.41 ["]
5	13 39 17.695 ^s	6 27 11.73 ["]	5	15 28 28.108 ^s	13 54 49.21 ["]
6	13 41 26.811 ^s	6 37 23.94 ["]	6	15 30 52.847 ^s	14 02 44.32 ["]
7	13 43 36.204 ^s	6 47 34.97 ["]	7	15 33 17.932 ^s	14 10 34.65 ["]
8	13 45 45.877 ^s	6 57 44.76 ["]	8	15 35 43.362 ^s	14 18 20.12 ["]
9	13 47 55.833 ^s	7 07 53.24 ["]	9	15 38 09.137 ^s	14 26 00.64 ["]
10	13 50 06.074 ^s	7 18 00.35 ["]	10	15 40 35.257 ^s	14 33 36.13 ["]
11	13 52 16.605 ^s	7 28 06.03 ["]	11	15 43 01.718 ^s	14 41 06.51 ["]
12	13 54 27.427 ^s	7 38 10.20 ["]	12	15 45 28.521 ^s	14 48 31.70 ["]
13	13 56 38.542 ^s	7 48 12.81 ["]	13	15 47 55.664 ^s	14 55 51.61 ["]
14	13 58 49.955 ^s	7 58 13.79 ["]	14	15 50 23.146 ^s	15 03 06.16 ["]
15	14 01 01.666 ^s	8 08 13.08 ["]	15	15 52 50.964 ^s	15 10 15.28 ["]
16	14 03 13.679 ^s	8 18 10.59 ["]	16	15 55 19.117 ^s	15 17 18.88 ["]
17	14 05 25.997 ^s	8 28 06.27 ["]	17	15 57 47.603 ^s	15 24 16.87 ["]
18	14 07 38.621 ^s	8 38 00.05 ["]	18	16 00 16.420 ^s	15 31 09.18 ["]
19	14 09 51.554 ^s	8 47 51.86 ["]	19	16 02 45.566 ^s	15 37 55.73 ["]
20	14 12 04.799 ^s	8 57 41.62 ["]	20	16 05 15.038 ^s	15 44 36.43 ["]
21	14 14 18.358 ^s	9 07 29.27 ["]	21	16 07 44.835 ^s	15 51 11.21 ["]
22	14 16 32.232 ^s	9 17 14.74 ["]	22	16 10 14.952 ^s	15 57 39.99 ["]
23	14 18 46.425 ^s	- 9 26 57.95 ["]	23	16 12 45.389 ^s	-16 04 02.69 ["]
	134.512	-580.88		150.752	-376.54
December 15			December 17		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	14 21 00.937 ^s	- 9 36 38.83 ["]	0	16 15 16.141 ^s	-16 10 19.23 ["]
1	14 23 15.773 ^s	9 46 17.31 ["]	1	16 17 47.207 ^s	16 16 29.53 ["]
2	14 25 30.932 ^s	9 55 53.32 ["]	2	16 20 18.582 ^s	16 22 33.52 ["]
3	14 27 46.418 ^s	10 05 26.78 ["]	3	16 22 50.263 ^s	16 28 31.12 ["]
4	14 30 02.232 ^s	10 14 57.62 ["]	4	16 25 22.247 ^s	16 34 22.26 ["]
5	14 32 18.376 ^s	10 24 25.76 ["]	5	16 27 54.531 ^s	16 40 06.85 ["]
6	14 34 34.851 ^s	10 33 51.12 ["]	6	16 30 27.111 ^s	16 45 44.83 ["]
7	14 36 51.660 ^s	10 43 13.64 ["]	7	16 32 59.983 ^s	16 51 16.13 ["]
8	14 39 08.804 ^s	10 52 33.24 ["]	8	16 35 33.142 ^s	16 56 40.67 ["]
9	14 41 26.284 ^s	11 01 49.83 ["]	9	16 38 06.586 ^s	17 01 58.37 ["]
10	14 43 44.103 ^s	11 11 03.34 ["]	10	16 40 40.309 ^s	17 07 09.18 ["]
11	14 46 02.260 ^s	11 20 13.69 ["]	11	16 43 14.307 ^s	17 12 13.02 ["]
12	14 48 20.758 ^s	11 29 20.81 ["]	12	16 45 48.577 ^s	17 17 09.82 ["]
13	14 50 39.597 ^s	11 38 24.61 ["]	13	16 48 23.112 ^s	17 21 59.52 ["]
14	14 52 58.780 ^s	11 47 25.03 ["]	14	16 50 57.909 ^s	17 26 42.04 ["]
15	14 55 18.306 ^s	11 56 21.96 ["]	15	16 53 32.962 ^s	17 31 17.33 ["]
16	14 57 38.176 ^s	12 05 15.35 ["]	16	16 56 08.267 ^s	17 35 45.32 ["]
17	14 59 58.393 ^s	12 14 05.10 ["]	17	16 58 43.818 ^s	17 40 05.95 ["]
18	15 02 18.955 ^s	12 22 51.14 ["]	18	17 01 19.610 ^s	17 44 19.16 ["]
19	15 04 39.865 ^s	12 31 33.39 ["]	19	17 03 55.638 ^s	17 48 24.88 ["]
20	15 07 01.121 ^s	12 40 11.76 ["]	20	17 06 31.895 ^s	17 52 23.06 ["]
21	15 09 22.726 ^s	12 48 46.18 ["]	21	17 09 08.377 ^s	17 56 13.64 ["]
22	15 11 44.679 ^s	12 57 16.55 ["]	22	17 11 45.078 ^s	17 59 56.57 ["]
23	15 14 06.981 ^s	13 05 42.81 ["]	23	17 14 21.992 ^s	18 03 31.79 ["]
24	15 16 29.631 ^s	-13 14 04.86 ["]	24	17 16 59.112 ^s	-18 06 59.25 ["]
	142.650	-502.05		157.120	-207.46

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 18							December 20						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	17	16	59.112	157.322	-18	06 59.25	0	19	24	27.875	158.573	-18	11 01.45
1	17	19	36.434	157.516	18	10 18.90	1	19	27	06.448	158.422	18	07 41.94
2	17	22	13.950	157.704	18	13 30.68	2	19	29	44.870	158.264	18	04 14.42
3	17	24	51.654	157.886	18	16 34.56	3	19	32	23.134	158.100	18	00 38.92
4	17	27	29.540	158.061	18	19 30.48	4	19	35	01.234	157.930	17	56 55.50
5	17	30	07.601	158.230	18	22 18.40	5	19	37	39.164	157.754	17	53 04.21
6	17	32	45.831	158.391	18	24 58.27	6	19	40	16.918	157.572	17	49 05.09
7	17	35	24.222	158.548	18	27 30.06	7	19	42	54.490	157.385	17	44 58.19
8	17	38	02.770	158.695	18	29 53.72	8	19	45	31.875	157.190	17	40 43.56
9	17	40	41.465	158.837	18	32 09.22	9	19	48	09.065	156.991	17	36 21.26
10	17	43	20.302	158.971	18	34 16.53	10	19	50	46.056	156.786	17	31 51.35
11	17	45	59.273	159.099	18	36 15.60	11	19	53	22.842	156.576	17	27 13.88
12	17	48	38.372	159.218	18	38 06.40	12	19	55	59.418	156.360	17	22 28.91
13	17	51	17.590	159.332	18	39 48.91	13	19	58	35.778	156.140	17	17 36.49
14	17	53	56.922	159.438	18	41 23.10	14	20	01	11.918	155.913	17	12 36.70
15	17	56	36.360	159.535	18	42 48.93	15	20	03	47.831	155.684	17	07 29.58
16	17	59	15.895	159.627	18	44 06.39	16	20	06	23.515	155.448	17	02 15.21
17	18	01	55.522	159.710	18	45 15.46	17	20	08	58.963	155.208	16	56 53.65
18	18	04	35.232	159.786	18	46 16.10	18	20	11	34.171	154.964	16	51 24.96
19	18	07	15.018	159.855	18	47 08.31	19	20	14	09.135	154.715	16	45 49.21
20	18	09	54.873	159.915	18	47 52.06	20	20	16	43.850	154.462	16	40 06.48
21	18	12	34.788	159.969	18	48 27.35	21	20	19	18.312	154.205	16	34 16.82
22	18	15	14.757	160.015	18	48 54.15	22	20	21	52.517	153.944	16	28 20.31
23	18	17	54.772	160.053	-18	49 12.47	23	20	24	26.461	153.680	-16	22 17.03
December 19							December 21						
0	18	20	34.825	160.083	-18	49 22.28	0	20	27	00.141	153.411	-16	16 07.03
1	18	23	14.908	160.107	18	49 23.59	1	20	29	33.552	153.138	16	09 50.40
2	18	25	55.015	160.121	18	49 16.38	2	20	32	06.690	152.864	16	03 27.21
3	18	28	35.136	160.130	18	49 00.66	3	20	34	39.554	152.585	15	56 57.53
4	18	31	15.266	160.129	18	48 36.43	4	20	37	12.139	152.303	15	50 21.44
5	18	33	55.395	160.121	18	48 03.69	5	20	39	44.442	152.019	15	43 39.01
6	18	36	35.516	160.107	18	47 22.43	6	20	42	16.461	151.731	15	36 50.33
7	18	39	15.623	160.083	18	46 32.68	7	20	44	48.192	151.441	15	29 55.47
8	18	41	55.706	160.053	18	45 34.43	8	20	47	19.633	151.148	15	22 54.50
9	18	44	35.759	160.015	18	44 27.70	9	20	49	50.781	150.853	15	15 47.51
10	18	47	15.774	159.969	18	43 12.49	10	20	52	21.634	150.555	15	08 34.58
11	18	49	55.743	159.917	18	41 48.82	11	20	54	52.189	150.256	15	01 15.78
12	18	52	35.660	159.855	18	40 16.72	12	20	57	22.445	149.954	14	53 51.20
13	18	55	15.515	159.789	18	38 36.18	13	20	59	52.399	149.650	14	46 20.92
14	18	57	55.304	159.713	18	36 47.25	14	21	02	22.049	149.345	14	38 45.01
15	19	00	35.017	159.630	18	34 49.93	15	21	04	51.394	149.038	14	31 03.57
16	19	03	14.647	159.541	18	32 44.25	16	21	07	20.432	148.730	14	23 16.66
17	19	05	54.188	159.445	18	30 30.24	17	21	09	49.162	148.420	14	15 24.38
18	19	08	33.633	159.340	18	28 07.93	18	21	12	17.582	148.109	14	07 26.81
19	19	11	12.973	159.230	18	25 37.34	19	21	14	45.691	147.796	13	59 24.03
20	19	13	52.203	159.111	18	22 58.51	20	21	17	13.487	147.484	13	51 16.12
21	19	16	31.314	158.987	18	20 11.46	21	21	19	40.971	147.169	13	43 03.16
22	19	19	10.301	158.856	18	17 16.25	22	21	22	08.140	146.855	13	34 45.25
23	19	21	49.157	158.718	18	14 12.90	23	21	24	34.995	146.539	13	26 22.46
24	19	24	27.875		-18	11 01.45	24	21	27	01.534		-13	17 54.87

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 22							December 24						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	21	27	01.534	146.223	-13	17 54.87	0	23	18	17.306	132.299	-5	24 36.07
1	21	29	27.757	145.907	13	09 22.58	1	23	20	29.605	132.064	5	13 52.04
2	21	31	53.664	145.591	13	00 45.66	2	23	22	41.669	131.830	5	03 07.07
3	21	34	19.255	145.274	12	52 04.20	3	23	24	53.499	131.600	4	52 21.22
4	21	36	44.529	144.957	12	43 18.27	4	23	27	05.099	131.372	4	41 34.57
5	21	39	09.486	144.640	12	34 27.98	5	23	29	16.471	131.148	4	30 47.16
6	21	41	34.126	144.324	12	25 33.39	6	23	31	27.619	130.927	4	19 59.07
7	21	43	58.450	144.007	12	16 34.60	7	23	33	38.546	130.709	4	09 10.37
8	21	46	22.457	143.692	12	07 31.68	8	23	35	49.255	130.494	3	58 21.10
9	21	48	46.149	143.376	11	58 24.72	9	23	37	59.749	130.282	3	47 31.34
10	21	51	09.525	143.061	11	49 13.81	10	23	40	10.031	130.073	3	36 41.15
11	21	53	32.586	142.747	11	39 59.02	11	23	42	20.104	129.867	3	25 50.58
12	21	55	55.333	142.434	11	30 40.43	12	23	44	29.971	129.664	3	14 59.70
13	21	58	17.767	142.121	11	21 18.14	13	23	46	39.635	129.465	3	04 08.56
14	22	00	39.888	141.809	11	11 52.22	14	23	48	49.100	129.269	2	53 17.24
15	22	03	01.697	141.499	11	02 22.75	15	23	50	58.369	129.075	2	42 25.78
16	22	05	23.196	141.189	10	52 49.82	16	23	53	07.444	128.885	2	31 34.24
17	22	07	44.385	140.881	10	43 13.51	17	23	55	16.329	128.699	2	20 42.69
18	22	10	05.266	140.574	10	33 33.90	18	23	57	25.028	128.515	2	09 51.17
19	22	12	25.840	140.269	10	23 51.07	19	23	59	33.543	128.334	1	58 59.75
20	22	14	46.109	139.964	10	14 05.09	20	00	01	41.877	128.157	1	48 08.48
21	22	17	06.073	139.662	10	04 16.06	21	00	03	50.034	127.983	1	37 17.42
22	22	19	25.735	139.361	9	54 24.05	22	00	05	58.017	127.812	1	26 26.63
23	22	21	45.096	139.061	-9	44 29.13	23	00	08	05.829	127.645	-1	15 36.15
December 23							December 25						
0	22	24	04.157	138.764	-9	34 31.40	0	0	10	13.474	127.479	-1	04 46.05
1	22	26	22.921	138.468	9	24 30.92	1	0	12	20.953	127.319	0	53 56.37
2	22	28	41.389	138.175	9	14 27.77	2	0	14	28.272	127.160	0	43 07.18
3	22	30	59.564	137.882	9	04 22.03	3	0	16	35.432	127.006	0	32 18.52
4	22	33	17.446	137.593	8	54 13.79	4	0	18	42.438	126.853	0	21 30.44
5	22	35	35.039	137.305	8	44 03.11	5	0	20	49.291	126.705	-0	10 43.01
6	22	37	52.344	137.019	8	33 50.07	6	0	22	55.996	126.560	+	00 03.74
7	22	40	09.363	136.736	8	23 34.75	7	0	25	02.556	126.417	0	10 49.74
8	22	42	26.099	136.454	8	13 17.22	8	0	27	08.973	126.279	0	21 34.95
9	22	44	42.553	136.176	8	02 57.56	9	0	29	15.252	126.142	0	32 19.32
10	22	46	58.729	135.899	7	52 35.84	10	0	31	21.394	126.010	0	43 02.80
11	22	49	14.628	135.625	7	42 12.14	11	0	33	27.404	125.880	0	53 45.33
12	22	51	30.253	135.353	7	31 46.53	12	0	35	33.284	125.753	1	04 26.87
13	22	53	45.606	135.085	7	21 19.08	13	0	37	39.037	125.630	1	15 07.37
14	22	56	00.691	134.817	7	10 49.86	14	0	39	44.667	125.510	1	25 46.78
15	22	58	15.508	134.553	7	00 18.95	15	0	41	50.177	125.392	1	36 25.06
16	23	00	30.061	134.292	6	49 46.42	16	0	43	55.569	125.278	1	47 02.15
17	23	02	44.353	134.034	6	39 12.33	17	0	46	00.847	125.167	1	57 38.01
18	23	04	58.387	133.777	6	28 36.76	18	0	48	06.014	125.059	2	08 12.59
19	23	07	12.164	133.524	6	17 59.78	19	0	50	11.073	124.954	2	18 45.84
20	23	09	25.688	133.273	6	07 21.45	20	0	52	16.027	124.852	2	29 17.72
21	23	11	38.961	133.025	5	56 41.85	21	0	54	20.879	124.753	2	39 48.19
22	23	13	51.986	132.781	5	46 01.04	22	0	56	25.632	124.657	2	50 17.19
23	23	16	04.767	132.539	5	35 19.09	23	0	58	30.289	124.564	3	00 44.69
24	23	18	17.306	132.299	-5	24 36.07	24	1	00	34.853	124.472	+	3 11 10.63

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 26			December 28		
h	h m s	° ' " "	h	h m s	° ' " "
0	1 00 34.853 ^s	+ 3 11 10.63 ["]	0	2 39 16.884 ^s	+ 10 48 07.56 ["]
1	1 02 39.326 ^s	3 21 34.98 ["]	1	2 41 20.020 ^s	10 56 28.59 ["]
2	1 04 43.713 ^s	3 31 57.68 ["]	2	2 43 23.177 ^s	11 04 46.17 ["]
3	1 06 48.015 ^s	3 42 18.70 ["]	3	2 45 26.359 ^s	11 13 00.27 ["]
4	1 08 52.236 ^s	3 52 38.00 ["]	4	2 47 29.565 ^s	11 21 10.87 ["]
5	1 10 56.378 ^s	4 02 55.52 ["]	5	2 49 32.798 ^s	11 29 17.92 ["]
6	1 13 00.445 ^s	4 13 11.23 ["]	6	2 51 36.059 ^s	11 37 21.40 ["]
7	1 15 04.439 ^s	4 23 25.08 ["]	7	2 53 39.349 ^s	11 45 21.27 ["]
8	1 17 08.363 ^s	4 33 37.03 ["]	8	2 55 42.669 ^s	11 53 17.52 ["]
9	1 19 12.219 ^s	4 43 47.05 ["]	9	2 57 46.020 ^s	12 01 10.09 ["]
10	1 21 16.011 ^s	4 53 55.08 ["]	10	2 59 49.405 ^s	12 08 58.97 ["]
11	1 23 19.741 ^s	5 04 01.09 ["]	11	3 01 52.823 ^s	12 16 44.12 ["]
12	1 25 23.412 ^s	5 14 05.04 ["]	12	3 03 56.276 ^s	12 24 25.51 ["]
13	1 27 27.027 ^s	5 24 06.88 ["]	13	3 05 59.766 ^s	12 32 03.11 ["]
14	1 29 30.589 ^s	5 34 06.58 ["]	14	3 08 03.292 ^s	12 39 36.90 ["]
15	1 31 34.099 ^s	5 44 04.09 ["]	15	3 10 06.857 ^s	12 47 06.83 ["]
16	1 33 37.560 ^s	5 53 59.37 ["]	16	3 12 10.460 ^s	12 54 32.89 ["]
17	1 35 40.976 ^s	6 03 52.39 ["]	17	3 14 14.104 ^s	13 01 55.05 ["]
18	1 37 44.349 ^s	6 13 43.11 ["]	18	3 16 17.788 ^s	13 09 13.26 ["]
19	1 39 47.681 ^s	6 23 31.49 ["]	19	3 18 21.514 ^s	13 16 27.51 ["]
20	1 41 50.974 ^s	6 33 17.48 ["]	20	3 20 25.283 ^s	13 23 37.77 ["]
21	1 43 54.232 ^s	6 43 01.05 ["]	21	3 22 29.094 ^s	13 30 44.00 ["]
22	1 45 57.456 ^s	6 52 42.16 ["]	22	3 24 32.949 ^s	13 37 46.18 ["]
23	1 48 00.650 ^s	+ 7 02 20.77 ["]	23	3 26 36.849 ^s	+ 13 44 44.29 ["]
		+ 576.08			+ 413.99
December 27			December 29		
0	1 50 03.815 ^s	+ 7 11 56.85 ["]	0	3 28 40.794 ^s	+ 13 51 38.28 ["]
1	1 52 06.954 ^s	7 21 30.36 ["]	1	3 30 44.785 ^s	13 58 28.15 ["]
2	1 54 10.069 ^s	7 31 01.25 ["]	2	3 32 48.821 ^s	14 05 13.85 ["]
3	1 56 13.162 ^s	7 40 29.50 ["]	3	3 34 52.905 ^s	14 11 55.36 ["]
4	1 58 16.236 ^s	7 49 55.07 ["]	4	3 36 57.035 ^s	14 18 32.65 ["]
5	2 00 19.293 ^s	7 59 17.91 ["]	5	3 39 01.213 ^s	14 25 05.71 ["]
6	2 02 22.336 ^s	8 08 37.99 ["]	6	3 41 05.439 ^s	14 31 34.49 ["]
7	2 04 25.366 ^s	8 17 55.28 ["]	7	3 43 09.713 ^s	14 37 58.98 ["]
8	2 06 28.385 ^s	8 27 09.74 ["]	8	3 45 14.036 ^s	14 44 19.15 ["]
9	2 08 31.396 ^s	8 36 21.34 ["]	9	3 47 18.407 ^s	14 50 34.97 ["]
10	2 10 34.400 ^s	8 45 30.03 ["]	10	3 49 22.827 ^s	14 56 46.43 ["]
11	2 12 37.401 ^s	8 54 35.79 ["]	11	3 51 27.296 ^s	15 02 53.48 ["]
12	2 14 40.399 ^s	9 03 38.57 ["]	12	3 53 31.814 ^s	15 08 56.11 ["]
13	2 16 43.397 ^s	9 12 38.34 ["]	13	3 55 36.382 ^s	15 14 54.30 ["]
14	2 18 46.396 ^s	9 21 35.08 ["]	14	3 57 40.998 ^s	15 20 48.01 ["]
15	2 20 49.399 ^s	9 30 28.73 ["]	15	3 59 45.664 ^s	15 26 37.23 ["]
16	2 22 52.408 ^s	9 39 19.28 ["]	16	4 01 50.378 ^s	15 32 21.94 ["]
17	2 24 55.423 ^s	9 48 06.68 ["]	17	4 03 55.142 ^s	15 38 02.10 ["]
18	2 26 58.448 ^s	9 56 50.90 ["]	18	4 05 59.955 ^s	15 43 37.69 ["]
19	2 29 01.484 ^s	10 05 31.91 ["]	19	4 08 04.816 ^s	15 49 08.70 ["]
20	2 31 04.532 ^s	10 14 09.66 ["]	20	4 10 09.726 ^s	15 54 35.10 ["]
21	2 33 07.595 ^s	10 22 44.14 ["]	21	4 12 14.684 ^s	15 59 56.86 ["]
22	2 35 10.673 ^s	10 31 15.31 ["]	22	4 14 19.690 ^s	16 05 13.97 ["]
23	2 37 13.769 ^s	10 39 43.12 ["]	23	4 16 24.743 ^s	16 10 26.41 ["]
24	2 39 16.884 ^s	+ 10 48 07.56 ["]	24	4 18 29.843 ^s	+ 16 15 34.15 ["]
		+ 504.44			+ 307.74

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
December 30									December 31										
h	h	m	s		°	'	"		h	h	m	s		°	'	"			
0	4	18	29.843	^s 125.147	+16	15	34.15	["] +303.01	0	5	08	44.714	^s 126.043	+17	54	21.02	["] +184.37		
1	4	20	34.990	^s 125.194		16	20	37.16	["] 298.28	1	5	10	50.757	^s 126.067		17	57	25.39	["] 179.24
2	4	22	40.184	^s 125.239		16	25	35.44	["] 293.52	2	5	12	56.824	^s 126.090		18	00	24.63	["] 174.09
3	4	24	45.423	^s 125.284		16	30	28.96	["] 288.74	3	5	15	02.914	^s 126.111		18	03	18.72	["] 168.95
4	4	26	50.707	^s 125.329		16	35	17.70	["] 283.95	4	5	17	09.025	^s 126.132		18	06	07.67	["] 163.78
5	4	28	56.036	^s 125.373		16	40	01.65	["] 279.12	5	5	19	15.157	^s 126.150		18	08	51.45	["] 158.61
6	4	31	01.409	^s 125.416		16	44	40.77	["] 274.28	6	5	21	21.307	^s 126.168		18	11	30.06	["] 153.43
7	4	33	06.825	^s 125.459		16	49	15.05	["] 269.43	7	5	23	27.475	^s 126.184		18	14	03.49	["] 148.24
8	4	35	12.284	^s 125.501		16	53	44.48	["] 264.55	8	5	25	33.659	^s 126.198		18	16	31.73	["] 143.04
9	4	37	17.785	^s 125.541		16	58	09.03	["] 259.66	9	5	27	39.857	^s 126.212		18	18	54.77	["] 137.83
10	4	39	23.326	^s 125.583		17	02	28.69	["] 254.76	10	5	29	46.069	^s 126.223		18	21	12.60	["] 132.62
11	4	41	28.909	^s 125.621		17	06	43.45	["] 249.82	11	5	31	52.292	^s 126.233		18	23	25.22	["] 127.39
12	4	43	34.530	^s 125.660		17	10	53.27	["] 244.88	12	5	33	58.525	^s 126.242		18	25	32.61	["] 122.16
13	4	45	40.190	^s 125.698		17	14	58.15	["] 239.91	13	5	36	04.767	^s 126.249		18	27	34.77	["] 116.92
14	4	47	45.888	^s 125.735		17	18	58.06	["] 234.94	14	5	38	11.016	^s 126.254		18	29	31.69	["] 111.68
15	4	49	51.623	^s 125.770		17	22	53.00	["] 229.95	15	5	40	17.270	^s 126.258		18	31	23.37	["] 106.43
16	4	51	57.393	^s 125.805		17	26	42.95	["] 224.94	16	5	42	23.528	^s 126.260		18	33	09.80	["] 101.18
17	4	54	03.198	^s 125.839		17	30	27.89	["] 219.92	17	5	44	29.788	^s 126.260		18	34	50.98	["] 95.92
18	4	56	09.037	^s 125.871		17	34	07.81	["] 214.88	18	5	46	36.048	^s 126.260		18	36	26.90	["] 90.65
19	4	58	14.908	^s 125.903		17	37	42.69	["] 209.82	19	5	48	42.308	^s 126.257		18	37	57.55	["] 85.39
20	5	00	20.811	^s 125.933		17	41	12.51	["] 204.76	20	5	50	48.565	^s 126.253		18	39	22.94	["] 80.11
21	5	02	26.744	^s 125.963		17	44	37.27	["] 199.68	21	5	52	54.818	^s 126.246		18	40	43.05	["] 74.84
22	5	04	32.707	^s 125.990		17	47	56.95	["] 194.59	22	5	55	01.064	^s 126.239		18	41	57.89	["] 69.57
23	5	06	38.697	^s 126.017		17	51	11.54	["] +189.48	23	5	57	07.303	^s 126.230		18	43	07.46	["] +64.28
24	5	08	44.714		+17	54	21.02		24	5	59	13.533		+18	44	11.74			

PHASES OF THE MOON

Lunation	New Moon			First Quarter			Full Moon			Last Quarter		
	^d	^h	^m	^d	^h	^m	^d	^h	^m	^d	^h	^m
458	Dec.	29	19 09	Jan.	5	18 53	Jan.	13	23 51	Jan.	21	15 01
459	Jan.	28	06 16	Feb.	4	14 27	Feb.	12	17 24	Feb.	19	23 48
460	Feb.	26	18 24	Mar.	5	11 06	Mar.	13	08 26	Mar.	20	06 41
461	Mar.	27	07 38	Apr.	4	07 05	Apr.	11	20 28	Apr.	18	12 57
462	Apr.	25	21 45	May	4	01 01	May	11	05 43	May	17	19 55
463	May	25	12 27	June	2	16 02	June	9	13 02	June	16	04 36
464	June	24	03 27	July	2	03 49	July	8	19 37	July	15	15 43
465	July	23	18 31	July	31	12 39	Aug.	7	02 41	Aug.	14	05 37
466	Aug.	22	09 16	Aug.	29	19 23	Sept.	5	11 19	Sept.	12	22 20
467	Sept.	20	23 13	Sept.	28	01 13	Oct.	4	22 17	Oct.	12	17 26
468	Oct.	20	12 03	Oct.	27	07 34	Nov.	3	11 58	Nov.	11	13 48
469	Nov.	18	23 47	Nov.	25	15 42	Dec.	3	04 25	Dec.	11	09 39
470	Dec.	18	10 47	Dec.	25	02 30	Jan.	1	23 06	Jan.	10	03 03

PERIGEE

^d	^h	^d	^h	^d	^h
Dec.	29 01	May	12 18	Sept.	29 22
Jan.	26 10	June	10 02	Oct.	24 20
Feb.	23 03	July	8 11	Nov.	21 04
Mar.	19 07	Aug.	5 20	Dec.	19 11
Apr.	14 19	Sept.	2 21		

APOGEE

^d	^h	^d	^h	^d	^h
Jan.	10 13	May	28 04	Oct.	12 13
Feb.	7 06	June	24 10	Nov.	9 09
Mar.	6 02	July	21 14	Dec.	7 03
Apr.	2 22	Aug.	18 01	Jan.	3 13
Apr.	30 16	Sept.	14 18		

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Jan. 0	6933.5	229 07 10.8	-0 09 18.4	0.453 2479	229.12917	2.92123
1	6934.5	232 00 09.4	0 30 31.8	.455 8171	232.03366	2.88840
2	6935.5	234 51 18.6	0 51 27.2	.458 1205	234.90726	2.85943
3	6936.5	237 40 52.9	1 12 03.1	.460 1548	237.75376	2.83420
4	6937.5	240 29 06.0	1 32 18.6	.461 9176	240.57687	2.81262
5	6938.5	243 16 11.5	-1 52 12.4	0.463 4066	243.38017	2.79457
6	6939.5	246 02 22.4	2 11 43.5	.464 6204	246.16716	2.77998
7	6940.5	248 47 51.4	2 30 50.8	.465 5570	248.94127	2.76880
8	6941.5	251 32 51.3	2 49 33.4	.466 2156	251.70589	2.76100
9	6942.5	254 17 34.4	3 07 50.2	.466 5952	254.46437	2.75650
10	6943.5	257 02 13.1	-3 25 40.1	0.466 6957	257.22000	2.75531
11	6944.5	259 46 59.4	3 43 01.9	.466 5169	259.97610	2.75743
12	6945.5	262 32 05.6	3 59 54.3	.466 0589	262.73596	2.76285
13	6946.5	265 17 44.0	4 16 16.2	.465 3224	265.50291	2.77161
14	6947.5	268 04 06.9	4 32 05.9	.464 3080	268.28030	2.78373
15	6948.5	270 51 26.6	-4 47 22.0	0.463 0169	271.07151	2.79927
16	6949.5	273 39 55.9	5 02 02.7	.461 4508	273.88000	2.81830
17	6950.5	276 29 47.6	5 16 06.1	.459 6117	276.70930	2.84090
18	6951.5	279 21 14.8	5 29 30.1	.457 5015	279.56303	2.86717
19	6952.5	282 14 31.1	5 42 12.4	.455 1234	282.44490	2.89721
20	6953.5	285 09 50.3	-5 54 10.5	0.452 4803	285.35875	2.93116
21	6954.5	288 07 26.7	6 05 21.5	.449 5761	288.30856	2.96915
22	6955.5	291 07 35.1	6 15 42.3	.446 4151	291.29845	3.01134
23	6956.5	294 10 30.9	6 25 09.5	.443 0025	294.33270	3.05792
24	6957.5	297 16 29.8	6 33 39.3	.439 3441	297.41580	3.10905
25	6958.5	300 25 48.5	-6 41 07.6	0.435 4463	300.55239	3.16496
26	6959.5	303 38 44.1	6 47 29.9	.431 3166	303.74738	3.22586
27	6960.5	306 55 34.4	6 52 41.2	.426 9638	307.00584	3.29196
28	6961.5	310 16 37.9	6 56 36.1	.422 3971	310.33313	3.36354
29	6962.5	313 42 14.1	6 59 08.8	.417 6277	313.73481	3.44080
30	6963.5	317 12 42.8	-7 00 12.8	0.412 6678	317.21671	3.52400
31	6964.5	320 48 24.6	6 59 41.3	.407 5316	320.78487	3.61338
Feb. 1	6965.5	324 29 40.9	6 57 27.1	.402 2345	324.44561	3.70919
2	6966.5	328 16 53.5	6 53 22.3	.396 7944	328.20544	3.81159
3	6967.5	332 10 24.7	6 47 18.9	.391 2311	332.07104	3.92075
4	6968.5	336 10 36.8	-6 39 08.3	0.385 5667	336.04923	4.03679
5	6969.5	340 17 52.6	6 28 42.1	.379 8258	340.14693	4.15975
6	6970.5	344 32 34.2	6 15 51.5	.374 0361	344.37100	4.28952
7	6971.5	348 55 03.1	6 00 28.1	.368 2281	348.72818	4.42591
8	6972.5	353 25 39.7	5 42 24.2	.362 4351	353.22489	4.56852
9	6973.5	358 04 42.8	-5 21 32.9	0.356 6939	357.86710	4.71677
10	6974.5	2 52 28.6	4 57 48.7	.351 0446	2.66003	4.86980
11	6975.5	7 49 09.9	4 31 08.1	.345 5300	7.60792	5.02648
12	6976.5	12 54 55.7	4 01 30.3	.340 1964	12.71371	5.18533
13	6977.5	18 09 49.3	3 28 57.8	.335 0926	17.97868	5.34449
14	6978.5	23 33 48.2	-2 53 37.3	0.330 2691	23.40205	5.50174
15	6979.5	29 06 42.0	-2 15 40.0	0.325 7780	28.98066	5.65448

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Feb. 15	6979.5	29 06 42.0	-2 15 40.0	0.325 7780	28.98066	5.65448
16	6980.5	34 48 11.8	1 35 22.8	.321 6715	34.70853	5.79977
17	6981.5	40 37 49.5	0 53 08.2	.318 0010	40.57665	5.93442
18	6982.5	46 34 56.4	-0 09 24.5	.314 8153	46.57273	6.05514
19	6983.5	52 38 43.3	+0 35 14.5	.312 1596	52.68118	6.15861
20	6984.5	58 48 10.5	+1 20 10.1	0.310 0728	58.88318	6.24178
21	6985.5	65 02 08.2	2 04 40.4	.308 5876	65.15708	6.30200
22	6986.5	71 19 18.2	2 48 01.5	.307 7273	71.47887	6.33730
23	6987.5	77 38 15.4	3 29 30.0	.307 5060	77.82295	6.34643
24	6988.5	83 57 30.1	4 08 24.5	.307 9270	84.16290	6.32908
25	6989.5	90 15 31.3	+4 44 08.3	0.308 9838	90.47248	6.28586
26	6990.5	96 30 49.5	5 16 10.7	.310 6592	96.72648	6.21824
27	6991.5	102 41 59.2	5 44 08.2	.312 9267	102.90156	6.12845
28	6992.5	108 47 42.2	6 07 45.2	.315 7520	108.97692	6.01928
29	6993.5	114 46 49.2	6 26 54.1	.319 0936	114.93470	5.89387
Mar. 1	6994.5	120 38 21.7	+6 41 34.7	0.322 9053	120.76035	5.75554
2	6995.5	126 21 32.5	6 51 53.1	.327 1372	126.44258	5.60760
3	6996.5	131 55 46.0	6 58 00.8	.331 7374	131.97338	5.45316
4	6997.5	137 20 37.8	7 00 13.4	.336 6536	137.34768	5.29506
5	6998.5	142 35 53.9	6 58 49.0	.341 8342	142.56310	5.13577
6	6999.5	147 41 29.3	+6 54 07.6	0.347 2293	147.61953	4.97741
7	7000.5	152 37 27.3	6 46 29.7	.352 7906	152.51882	4.82173
8	7001.5	157 23 57.2	6 36 15.5	.358 4730	157.26434	4.67008
9	7002.5	162 01 13.9	6 23 44.7	.364 2346	161.86067	4.52350
10	7003.5	166 29 36.4	6 09 15.9	.370 0360	166.31330	4.38278
11	7004.5	170 49 26.3	+5 53 06.2	0.375 8419	170.62835	4.24842
12	7005.5	175 01 07.5	5 35 31.4	.381 6196	174.81237	4.12075
13	7006.5	179 05 05.1	5 16 45.4	.387 3394	178.87214	3.99994
14	7007.5	183 01 44.9	4 57 01.0	.392 9748	182.81456	3.88605
15	7008.5	186 51 32.8	4 36 29.3	.398 5020	186.64652	3.77899
16	7009.5	190 34 54.6	+4 15 20.1	0.403 8997	190.37479	3.67866
17	7010.5	194 12 15.5	3 53 42.1	.409 1484	194.00603	3.58489
18	7011.5	197 44 00.0	3 31 42.6	.414 2315	197.54668	3.49745
19	7012.5	201 10 32.0	3 09 28.3	.419 1335	201.00297	3.41612
20	7013.5	204 32 14.3	2 47 04.6	.423 8411	204.38088	3.34066
21	7014.5	207 49 28.9	+2 24 36.5	0.428 3424	207.68616	3.27081
22	7015.5	211 02 36.7	2 02 08.1	.432 6268	210.92430	3.20635
23	7016.5	214 11 57.8	1 39 43.0	.436 6852	214.10057	3.14703
24	7017.5	217 17 51.4	1 17 24.3	.440 5092	217.22000	3.09263
25	7018.5	220 20 35.7	0 55 14.6	.444 0920	220.28740	3.04293
26	7019.5	223 20 28.3	+0 33 16.4	0.447 4268	223.30737	2.99774
27	7020.5	226 17 45.9	+0 11 31.6	.450 5083	226.28433	2.95688
28	7021.5	229 12 44.4	-0 09 58.1	.453 3314	229.22251	2.92016
29	7022.5	232 05 39.4	0 31 11.0	.455 8926	232.12599	2.88745
30	7023.5	234 56 45.5	0 52 05.8	.458 1876	234.99869	2.85859
31	7024.5	237 46 17.0	-1 12 41.1	0.460 2137	237.84442	2.83348
Apr. 1	7025.5	240 34 27.9	-1 32 55.9	0.461 9680	240.66686	2.81200

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Apr. 1	7025.5	240° 34' 27.9"	-1° 32' 55.9"	0.461 9680	240.66686	2.81200
2	7026.5	243 21 31.5	1 52 49.0	.463 4485	243.46960	2.79406
3	7027.5	246 07 40.8	2 12 19.4	.464 6537	246.25614	2.77958
4	7028.5	248 53 08.8	2 31 26.0	.465 5817	249.02990	2.76852
5	7029.5	251 38 08.0	2 50 07.8	.466 2317	251.79429	2.76081
6	7030.5	254 22 50.8	-3 08 23.8	0.466 6028	254.55262	2.75641
7	7031.5	257 07 29.4	3 26 12.8	.466 6946	257.30822	2.75532
8	7032.5	259 52 16.2	3 43 33.7	.466 5072	260.06437	2.75754
9	7033.5	262 37 23.2	4 00 25.2	.466 0405	262.82440	2.76306
10	7034.5	265 23 02.7	4 16 46.1	.465 2953	265.59161	2.77192
11	7035.5	268 09 27.1	-4 32 34.8	0.464 2725	268.36937	2.78416
12	7036.5	270 56 48.8	4 47 49.8	.462 9729	271.16106	2.79980
13	7037.5	273 45 20.5	5 02 29.4	.461 3983	273.97014	2.81894
14	7038.5	276 35 14.9	5 16 31.6	.459 5507	276.80013	2.84165
15	7039.5	279 26 45.3	5 29 54.4	.457 4322	279.65467	2.86804
16	7040.5	282 20 05.1	-5 42 35.3	0.455 0458	282.53747	2.89820
17	7041.5	285 15 28.4	5 54 32.0	.452 3946	285.45237	2.93226
18	7042.5	288 13 09.2	6 05 41.5	.449 4823	288.40335	2.97038
19	7043.5	291 13 22.6	6 16 00.7	.446 3136	291.39454	3.01271
20	7044.5	294 16 23.7	6 25 26.1	.442 8933	294.43023	3.05942
21	7045.5	297 22 28.6	-6 33 54.1	0.439 2273	297.51491	3.11071
22	7046.5	300 31 53.7	6 41 20.5	.435 3221	300.65324	3.16677
23	7047.5	303 44 56.3	6 47 40.7	.431 1855	303.85011	3.22782
24	7048.5	307 01 54.1	6 52 49.7	.426 8256	307.11062	3.29409
25	7049.5	310 23 05.8	6 56 42.2	.422 2526	310.44012	3.36583
26	7050.5	313 48 50.7	-6 59 12.2	0.417 4768	313.84419	3.44328
27	7051.5	317 19 28.8	7 00 13.3	.412 5113	317.32866	3.52668
28	7052.5	320 55 20.6	6 59 38.8	.407 3699	320.89960	3.61625
29	7053.5	324 36 47.6	6 57 21.2	.402 0682	324.56330	3.71225
30	7054.5	328 24 11.6	6 53 12.9	.396 6239	328.32630	3.81486
May 1	7055.5	332 17 54.8	-6 47 05.7	0.391 0571	332.19528	3.92424
2	7056.5	336 18 19.7	6 38 51.0	.385 3900	336.17707	4.04049
3	7057.5	340 25 49.0	6 28 20.5	.379 6471	340.27857	4.16366
4	7058.5	344 40 44.7	6 15 25.2	.373 8563	344.50667	4.29365
5	7059.5	349 03 28.4	5 59 57.0	.368 0481	348.86807	4.43023
6	7060.5	353 34 20.5	-5 41 48.1	0.362 2561	353.36920	4.57303
7	7061.5	358 13 39.6	5 20 51.5	.356 5171	358.01601	4.72145
8	7062.5	3 01 41.8	4 57 01.8	.350 8712	2.81369	4.87461
9	7063.5	7 58 39.9	4 30 15.7	.345 3616	7.76644	5.03138
10	7064.5	13 04 42.6	4 00 32.5	.340 0345	12.87716	5.19027
11	7065.5	18 19 53.3	-3 27 54.7	0.334 9385	18.14707	5.34941
12	7066.5	23 44 08.9	2 52 29.0	.330 1245	23.57532	5.50655
13	7067.5	29 17 19.0	2 14 27.2	.325 6446	29.15865	5.65911
14	7068.5	34 59 04.5	1 34 06.0	.321 5509	34.89103	5.80413
15	7069.5	40 48 56.7	0 51 48.1	.317 8947	40.76333	5.93840
16	7070.5	46 46 16.8	-0 08 02.1	0.314 7248	46.76314	6.05861
17	7071.5	52 50 15.2	+0 36 37.9	0.312 0861	52.87478	6.16151

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
243						
May	17 7071.5	52 50 15.2	+0 36 37.9	0.312 0861	52.87478	6.16151
	18 7072.5	58 59 51.9	1 21 33.4	.310 0177	59.07935	6.24400
	19 7073.5	65 13 56.8	2 06 02.2	.308 5517	65.35511	6.30349
	20 7074.5	71 31 11.4	2 49 20.5	.307 7111	71.67798	6.33797
	21 7075.5	77 50 10.4	3 30 44.8	.307 5094	78.02231	6.34628
	22 7076.5	84 09 24.2	+4 09 33.9	0.307 9503	84.36170	6.32812
	23 7077.5	90 27 21.7	4 45 11.3	.309 0266	90.66992	6.28411
	24 7078.5	96 42 33.3	5 17 06.4	.310 7209	96.92180	6.21577
	25 7079.5	102 53 34.0	5 44 56.0	.313 0064	103.09409	6.12534
	26 7080.5	108 59 05.7	6 08 24.8	.315 8483	109.16604	6.01560
	27 7081.5	114 57 59.4	+6 27 25.4	0.319 2053	115.11992	5.88974
	28 7082.5	120 49 17.0	6 41 57.7	.323 0306	120.94125	5.75108
	29 7083.5	126 32 11.6	6 52 08.1	.327 2745	126.61890	5.60289
	30 7084.5	132 06 07.9	6 58 08.3	.331 8854	132.14489	5.44828
	31 7085.5	137 30 42.0	7 00 13.9	.336 8106	137.51428	5.29011
June	1 7086.5	142 45 40.1	+6 58 43.2	0.341 9987	142.72475	5.13083
	2 7087.5	147 50 57.5	6 53 56.0	.347 3995	147.77628	4.97254
	3 7088.5	152 46 37.6	6 46 12.9	.352 9652	152.67073	4.81695
	4 7089.5	157 32 50.2	6 35 54.2	.358 6509	157.41155	4.66545
	5 7090.5	162 09 50.0	6 23 19.5	.364 4141	162.00333	4.51904
	6 7091.5	166 37 56.2	+6 08 47.4	0.370 2162	166.45159	4.37851
	7 7092.5	170 57 30.6	5 52 34.8	.376 0216	170.76247	4.24435
	8 7093.5	175 08 57.0	5 34 57.6	.381 7978	174.94253	4.11690
	9 7094.5	179 12 40.7	5 16 09.6	.387 5154	178.99856	3.99631
	10 7095.5	183 09 07.3	4 56 23.6	.393 1478	182.93745	3.88262
	11 7096.5	186 58 42.9	+4 35 50.6	0.398 6712	186.76609	3.77579
	12 7097.5	190 41 53.1	4 14 40.4	.404 0644	190.49127	3.67566
	13 7098.5	194 19 03.1	3 53 01.6	.409 3082	194.11960	3.58208
	14 7099.5	197 50 37.7	3 31 01.6	.414 3857	197.65755	3.49484
	15 7100.5	201 17 00.3	3 08 46.9	.419 2819	201.11132	3.41370
	16 7101.5	204 38 34.1	+2 46 23.0	0.423 9833	204.48690	3.33841
	17 7102.5	207 55 40.7	2 23 54.8	.428 4780	207.79002	3.26875
	18 7103.5	211 08 41.2	2 01 26.5	.432 7556	211.02618	3.20444
	19 7104.5	214 17 55.7	1 39 01.5	.436 8067	214.20062	3.14528
	20 7105.5	217 23 43.2	1 16 43.0	.440 6233	217.31838	3.09104
	21 7106.5	220 26 22.0	+0 54 33.7	0.444 1984	220.38426	3.04148
	22 7107.5	223 26 09.6	0 32 35.9	.447 5254	223.40284	2.99643
	23 7108.5	226 23 22.6	+0 10 51.5	.450 5990	226.37855	2.95569
	24 7109.5	229 18 17.1	-0 10 37.7	.453 4142	229.31560	2.91909
	25 7110.5	232 11 08.5	0 31 50.1	.455 9669	232.21807	2.88651
	26 7111.5	235 02 11.5	-0 52 44.2	0.458 2536	235.08990	2.85778
	27 7112.5	237 51 40.4	1 13 19.0	.460 2713	237.93487	2.83277
	28 7113.5	240 39 49.0	1 33 33.1	.462 0174	240.75665	2.81139
	29 7114.5	243 26 50.8	1 53 25.5	.463 4894	243.55884	2.79357
	30 7115.5	246 12 58.7	2 12 55.2	.464 6859	246.34495	2.77921
July	1 7116.5	248 58 25.7	-2 32 01.1	0.465 6054	249.11839	2.76824
	2 7117.5	251 43 24.2	-2 50 42.1	0.466 2467	251.88255	2.76064

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
July	²⁴³ 1 7116.5	248° 58' 25.7	-2° 32' 01.1	0.465 6054	249.11839	2.76824
	2 7117.5	251 43 24.2	2 50 42.1	.466 2467	251.88255	2.76064
	3 7118.5	254 28 06.7	3 08 57.3	.466 6091	254.64077	2.75634
	4 7119.5	257 12 45.5	3 26 45.4	.466 6925	257.39634	2.75535
	5 7120.5	259 57 32.7	3 44 05.4	.466 4965	260.15258	2.75768
	6 7121.5	262 42 40.6	-4 00 56.1	0.466 0212	262.91280	2.76331
	7 7122.5	265 28 21.4	4 17 16.0	.465 2676	265.68030	2.77226
	8 7123.5	268 14 47.5	4 33 03.7	.464 2363	268.45844	2.78460
	9 7124.5	271 02 11.2	4 48 17.6	.462 9282	271.25063	2.80035
	10 7125.5	273 50 45.2	5 02 56.1	.461 3451	274.06031	2.81960
	11 7126.5	276 40 42.4	-5 16 57.1	0.459 4892	276.89102	2.84242
	12 7127.5	279 32 16.0	5 30 18.6	.457 3624	279.74638	2.86891
	13 7128.5	282 25 39.5	5 42 58.2	.454 9679	282.63011	2.89919
	14 7129.5	285 21 06.7	5 54 53.4	.452 3088	285.54607	2.93339
	15 7130.5	288 18 52.1	6 06 01.4	.449 3887	288.49824	2.97163
	16 7131.5	291 19 10.4	-6 16 19.0	0.446 2123	291.49074	3.01409
	17 7132.5	294 22 17.0	6 25 42.8	.442 7844	294.52788	3.06094
	18 7133.5	297 28 27.8	6 34 08.9	.439 1111	297.61414	3.11236
	19 7134.5	300 37 59.3	6 41 33.3	.435 1988	300.75419	3.16857
	20 7135.5	303 51 08.8	6 47 51.4	.431 0553	303.95294	3.22978
	21 7136.5	307 08 14.2	-6 52 58.1	0.426 6891	307.21549	3.29621
	22 7137.5	310 29 34.0	6 56 48.1	.422 1097	310.54719	3.36812
	23 7138.5	313 55 27.6	6 59 15.4	.417 3283	313.95364	3.44574
	24 7139.5	317 26 14.9	7 00 13.7	.412 3573	317.44066	3.52931
	25 7140.5	321 02 16.7	6 59 36.1	.407 2108	321.01433	3.61909
	26 7141.5	324 43 54.3	-6 57 15.2	0.401 9046	324.68097	3.71528
	27 7142.5	328 31 29.4	6 53 03.4	.396 4566	328.44709	3.81808
	28 7143.5	332 25 24.5	6 46 52.3	.390 8864	332.31940	3.92767
	29 7144.5	336 26 02.0	6 38 33.7	.385 2169	336.30473	4.04414
	30 7145.5	340 33 44.5	6 27 58.7	.379 4724	340.40998	4.16751
Aug.	31 7146.5	344 48 54.1	-6 14 59.0	0.373 6809	344.64202	4.29768
	1 7147.5	349 11 52.3	5 59 25.9	.367 8729	349.00755	4.43446
	2 7148.5	353 42 59.4	5 41 11.9	.362 0822	353.51301	4.57745
	3 7149.5	358 22 34.1	5 20 10.1	.356 3457	358.16430	4.72600
	4 7150.5	3 10 52.2	4 56 15.1	.350 7034	2.96658	4.87927
	5 7151.5	8 08 06.5	-4 29 23.6	0.345 1989	7.92404	5.03613
	6 7152.5	13 14 25.7	3 59 34.9	.339 8782	13.03953	5.19505
	7 7153.5	18 29 52.7	3 26 51.9	.334 7902	18.31421	5.35416
	8 7154.5	23 54 24.5	2 51 21.3	.329 9858	23.74716	5.51119
	9 7155.5	29 27 50.3	2 13 14.9	.325 5169	29.33504	5.66356
	10 7156.5	35 09 50.7	-1 32 49.8	0.321 4358	35.07173	5.80828
	11 7157.5	40 59 56.8	0 50 28.9	.317 7937	40.94799	5.94217
	12 7158.5	46 57 29.4	-0 06 40.8	.314 6394	46.95136	6.06192
	13 7159.5	53 01 38.7	+0 38 00.3	.312 0175	53.06601	6.16422
	14 7160.5	59 11 24.2	1 22 55.6	.309 9670	59.27297	6.24605
	15 7161.5	65 25 35.7	+2 07 22.8	0.308 5196	65.55041	6.30480
	16 7162.5	71 42 54.3	+2 50 38.2	0.307 6979	71.87421	6.33851

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Aug. 16	7162.5	71° 42' 54.3"	+2° 50' 38.2"	0.307 6979	71.87421	6.33851
17	7163.5	78 01 54.8	3 31 58.3	.307 5158	78.21869	6.34602
18	7164.5	84 21 07.3	4 10 42.1	.307 9762	84.55742	6.32706
19	7165.5	90 39 00.7	4 46 13.1	.309 0714	90.86421	6.28231
20	7166.5	96 54 05.7	5 18 01.0	.310 7837	97.11394	6.21327
21	7167.5	103 04 57.3	+5 45 42.9	0.313 0863	103.28340	6.12221
22	7168.5	109 10 17.7	6 09 03.6	.315 9443	109.35196	6.01196
23	7169.5	115 08 58.2	6 27 55.9	.319 3159	115.30197	5.88567
24	7170.5	121 00 01.0	6 42 20.1	.323 1545	121.11907	5.74667
25	7171.5	126 42 39.7	6 52 22.7	.327 4100	126.79218	5.59826
26	7172.5	132 16 19.2	+6 58 15.6	0.332 0310	132.31348	5.44352
27	7173.5	137 40 36.0	7 00 14.3	.336 9647	137.67806	5.28529
28	7174.5	142 55 16.5	6 58 37.3	.342 1597	142.88371	5.12601
29	7175.5	148 00 16.4	6 53 44.4	.347 5660	147.93044	4.96778
30	7176.5	152 55 39.2	6 45 56.3	.353 1358	152.82020	4.81232
31	7177.5	157 41 34.8	+6 35 33.1	0.358 8242	157.55645	4.66095
Sept. 1	7178.5	162 18 18.3	6 22 54.6	.364 5889	162.14382	4.51472
2	7179.5	166 46 08.7	6 08 19.1	.370 3913	166.58785	4.37437
3	7180.5	171 05 28.0	5 52 03.8	.376 1960	170.89469	4.24042
4	7181.5	175 16 40.1	5 34 24.1	.381 9709	175.07092	4.11318
5	7182.5	179 20 10.3	+5 15 34.2	0.387 6863	179.12333	3.99280
6	7183.5	183 16 24.2	4 55 46.6	.393 3156	183.05882	3.87932
7	7184.5	187 05 47.8	4 35 12.3	.398 8353	186.88426	3.77269
8	7185.5	190 48 46.9	4 14 01.1	.404 2243	190.60644	3.67278
9	7186.5	194 25 46.6	3 52 21.5	.409 4632	194.23199	3.57938
10	7187.5	197 57 11.4	+3 30 20.9	0.414 5354	197.76732	3.49233
11	7188.5	201 23 25.2	3 08 05.8	.419 4258	201.21868	3.41138
12	7189.5	204 44 50.6	2 45 41.7	.424 1208	204.59202	3.33625
13	7190.5	208 01 49.6	2 23 13.5	.428 6091	207.89306	3.26674
14	7191.5	211 14 43.1	2 00 45.1	.432 8800	211.12730	3.20261
15	7192.5	214 23 51.1	+1 38 20.3	0.436 9242	214.29999	3.14360
16	7193.5	217 29 32.7	1 16 02.1	.440 7337	217.41614	3.08949
17	7194.5	220 32 06.2	0 53 53.0	.444 3013	220.48054	3.04008
18	7195.5	223 31 48.9	0 31 55.6	.447 6208	223.49779	2.99516
19	7196.5	226 28 57.7	+0 10 11.6	.450 6867	226.47229	2.95454
20	7197.5	229 23 48.3	-0 11 17.1	0.453 4941	229.40826	2.91808
21	7198.5	232 16 36.3	0 32 28.9	.456 0390	232.30978	2.88560
22	7199.5	235 07 36.3	0 53 22.6	.458 3178	235.18075	2.85698
23	7200.5	237 57 02.6	1 13 56.7	.460 3275	238.02498	2.83209
24	7201.5	240 45 09.1	1 34 10.2	.462 0652	240.84614	2.81083
25	7202.5	243 32 09.0	-1 54 02.0	0.463 5293	243.64781	2.79310
26	7203.5	246 18 15.6	2 13 30.9	.464 7177	246.43349	2.77883
27	7204.5	249 03 41.6	2 32 36.0	.465 6289	249.20661	2.76797
28	7205.5	251 48 39.5	2 51 16.3	.466 2619	251.97055	2.76046
29	7206.5	254 33 21.7	3 09 30.6	.466 6162	254.72863	2.75626
30	7207.5	257 18 00.5	-3 27 17.9	0.466 6912	257.48418	2.75538
Oct. 1	7208.5	260 02 48.2	-3 44 37.1	0.466 4870	260.24049	2.75779

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
Oct.	²⁴³ 7208.5	260° 02' 48".2	-3° 44' 37".1	0.466 4870	260° 24049	2.75779
	7209.5	262 47 56.9	4 01 26.7	.466 0035	263.00086	2.76351
	7210.5	265 33 38.8	4 17 45.7	.465 2417	265.76862	2.77257
	7211.5	268 20 06.4	4 33 32.4	.464 2022	268.54713	2.78501
	7212.5	271 07 31.9	4 48 45.2	.462 8861	271.33977	2.80086
	7213.5	273 56 08.2	-5 03 22.5	0.461 2951	274.15001	2.82022
	7214.5	276 46 08.0	5 17 22.4	.459 4312	276.98139	2.84314
	7215.5	279 37 44.7	5 30 42.6	.457 2966	279.83752	2.86974
	7216.5	282 31 11.5	5 43 20.9	.454 8943	282.72213	2.90013
	7217.5	285 26 42.6	5 55 14.7	.452 2275	285.63909	2.93445
	7218.5	288 24 32.2	-6 06 21.2	0.449 3000	288.59237	2.97280
	7219.5	291 24 55.2	6 16 37.1	.446 1161	291.58610	3.01539
	7220.5	294 28 07.0	6 25 59.2	.442 6810	294.62461	3.06237
	7221.5	297 34 23.4	6 34 23.5	.439 0005	297.71236	3.11392
	7222.5	300 44 01.0	6 41 45.9	.435 0815	300.85405	3.17028
	7223.5	303 57 17.1	-6 48 01.8	0.430 9313	304.05458	3.23164
	7224.5	307 14 29.6	6 53 06.3	.426 5585	307.31907	3.29823
	7225.5	310 35 57.1	6 56 53.8	.421 9730	310.65286	3.37030
	7226.5	314 01 59.0	6 59 18.6	.417 1861	314.06157	3.44809
	7227.5	317 32 55.1	7 00 14.0	.412 2098	317.55102	3.53183
	7228.5	321 09 06.3	-6 59 33.4	0.407 0584	321.12730	3.62179
	7229.5	324 50 54.0	6 57 09.3	.401 7477	324.79674	3.71818
	7230.5	328 38 39.9	6 52 53.9	.396 2956	328.56586	3.82118
	7231.5	332 32 46.4	6 46 39.2	.390 7224	332.44136	3.93097
	7232.5	336 33 36.0	6 38 16.5	.385 0501	336.43009	4.04764
	7233.5	340 41 31.1	-6 27 37.3	0.379 3039	340.53894	4.17121
	7234.5	344 56 54.1	6 14 33.1	.373 5113	344.77478	4.30159
	7235.5	349 20 06.3	5 58 55.3	.367 7032	349.14431	4.43855
	7236.5	353 51 27.9	5 40 36.4	.361 9134	353.65394	4.58170
	7237.5	358 31 17.6	5 19 29.4	.356 1790	358.30957	4.73042
Nov.	7238.5	3 19 51.3	-4 55 29.2	0.350 5401	3.11634	4.88382
	7239.5	8 17 21.5	4 28 32.4	.345 0400	8.07840	5.04077
	7240.5	13 23 56.7	3 58 38.5	.339 7253	13.19856	5.19973
	7241.5	18 39 39.8	3 25 50.3	.334 6447	18.47790	5.35880
	7242.5	24 04 27.4	2 50 14.9	.329 8491	23.91545	5.51575
	7243.5	29 38 08.6	-2 12 04.1	0.325 3907	29.50781	5.66794
	7244.5	35 20 23.8	1 31 35.2	.321 3217	35.24875	5.81240
	7245.5	41 10 43.7	0 49 11.2	.317 6932	41.12897	5.94594
	7246.5	47 08 28.8	-0 05 21.1	.314 5536	47.13587	6.06522
	7247.5	53 12 49.0	+0 39 21.0	.311 9478	53.25356	6.16698
	7248.5	59 22 43.5	+1 24 16.1	0.309 9144	59.46296	6.24817
	7249.5	65 37 01.9	2 08 41.8	.308 4848	65.74217	6.30620
	7250.5	71 54 25.0	2 51 54.4	.307 6818	72.06700	6.33917
	7251.5	78 13 27.3	3 33 10.4	.307 5186	78.41175	6.34590
	7252.5	84 32 39.0	4 11 48.9	.307 9976	84.74997	6.32617
	7253.5	90 50 29.1	+4 47 13.7	0.309 1111	91.05550	6.28069
	7254.5	97 05 28.0	+5 18 54.6	0.310 8411	97.30326	6.21097

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	243					
Nov. 16	7254.5	97 05 28.0	+5 18 54.6	0.310 8411	97.30326	6.21097
17	7255.5	103 16 11.2	5 46 28.8	.313 1607	103.47011	6.11929
18	7256.5	109 21 21.0	6 09 41.5	.316 0343	109.53548	6.00853
19	7257.5	115 19 49.2	6 28 25.8	.319 4204	115.48185	5.88182
20	7258.5	121 10 38.0	6 42 42.0	.323 2719	121.29491	5.74249
21	7259.5	126 53 01.4	+6 52 37.0	0.327 5390	126.96372	5.59385
22	7260.5	132 26 25.0	6 58 22.5	.332 1699	132.48053	5.43898
23	7261.5	137 50 25.2	7 00 14.4	.337 1121	137.84053	5.28067
24	7262.5	143 04 48.8	6 58 31.2	.342 3142	143.04154	5.12138
25	7263.5	148 09 31.8	6 53 32.7	.347 7260	148.08366	4.96321
26	7264.5	153 04 37.8	+6 45 39.6	0.353 3001	152.96889	4.80784
27	7265.5	157 50 17.1	6 35 12.0	.358 9914	157.70072	4.65661
28	7266.5	162 26 44.7	6 22 29.7	.364 7580	162.28383	4.51054
29	7267.5	166 54 19.9	6 07 50.9	.370 5612	166.72376	4.37036
30	7268.5	171 13 24.6	5 51 32.7	.376 3656	171.02669	4.23660
Dec. 1	7269.5	175 24 22.8	+5 33 50.6	0.382 1392	175.19920	4.10956
2	7270.5	179 27 39.8	5 14 58.8	.387 8523	179.24809	3.98937
3	7271.5	183 23 41.3	4 55 09.5	.393 4789	183.18025	3.87610
4	7272.5	187 12 53.3	4 34 33.9	.398 9951	187.00257	3.76966
5	7273.5	190 55 41.4	4 13 21.7	.404 3801	190.72181	3.66993
6	7274.5	194 32 30.9	+3 51 41.3	0.409 6145	194.34461	3.57674
7	7275.5	198 03 46.2	3 29 40.1	.414 6815	197.87740	3.48987
8	7276.5	201 29 51.2	3 07 24.6	.419 5664	201.32637	3.40908
9	7277.5	204 51 08.4	2 45 00.3	.424 2558	204.69750	3.33413
10	7278.5	208 07 59.9	2 22 31.9	.428 7378	207.99650	3.26478
11	7279.5	211 20 46.4	+2 00 03.6	0.433 0023	211.22885	3.20080
12	7280.5	214 29 48.1	1 37 38.9	.437 0398	214.39980	3.14194
13	7281.5	217 35 23.8	1 15 20.9	.440 8423	217.51435	3.08796
14	7282.5	220 37 52.0	0 53 12.2	.444 4028	220.57728	3.03868
15	7283.5	223 37 30.0	0 31 15.0	.447 7149	223.59320	2.99389
16	7284.5	226 34 34.3	+0 09 31.5	0.450 7732	226.56649	2.95340
17	7285.5	229 29 21.1	-0 11 56.7	.453 5729	229.50138	2.91706
18	7286.5	232 22 05.7	0 33 08.0	.456 1100	232.40193	2.88470
19	7287.5	235 13 02.7	0 54 01.1	.458 3809	235.27206	2.85618
20	7288.5	238 02 26.5	1 14 34.6	.460 3825	238.11554	2.83140
21	7289.5	240 50 30.7	-1 34 47.5	0.462 1122	240.93607	2.81025
22	7290.5	243 37 28.9	1 54 38.5	.463 5681	243.73721	2.79262
23	7291.5	246 23 34.1	2 14 06.8	.464 7482	246.52247	2.77846
24	7292.5	249 08 59.0	2 33 11.2	.465 6512	249.29526	2.76769
25	7293.5	251 53 56.2	2 51 50.6	.466 2758	252.05897	2.76028
26	7294.5	254 38 38.2	-3 10 04.1	0.466 6218	254.81693	2.75620
27	7295.5	257 23 17.2	3 27 50.6	.466 6885	257.57246	2.75540
28	7296.5	260 08 05.3	3 45 08.8	.466 4758	260.32884	2.75792
29	7297.5	262 53 14.8	4 01 57.6	.465 9839	263.08940	2.76375
30	7298.5	265 38 58.0	4 18 15.5	.465 2137	265.85744	2.77290
31	7299.5	268 25 27.1	-4 34 01.2	0.464 1659	268.63632	2.78543
32	7300.5	271 12 54.6	-4 49 13.0	0.462 8412	271.42945	2.80140

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243	° ' "	° ' "		°	°	°
Jan. -1	6932.5	170 47 18.8	+3 23 02.1	0.719 5412	170.78075	1.61905	-0.12
1	6934.5	174 01 53.1	3 21 48.9	.719 7220	174.01804	.61823	.13
3	6936.5	177 16 20.7	3 19 57.0	.719 9142	177.25365	.61737	.15
5	6938.5	180 30 41.0	3 17 27.0	.720 1170	180.48749	.61646	.16
7	6940.5	183 44 53.5	3 14 19.3	.720 3299	183.71946	.61550	.17
9	6942.5	186 58 57.6	+3 10 34.7	0.720 5521	186.94948	1.61451	-0.18
11	6944.5	190 12 52.9	3 06 13.9	.720 7830	190.17747	.61348	.19
13	6946.5	193 26 39.0	3 01 17.8	.721 0219	193.40336	.61241	.20
15	6948.5	196 40 15.3	2 55 47.5	.721 2678	196.62708	.61130	.21
17	6950.5	199 53 41.6	2 49 44.1	.721 5202	199.84856	.61018	.22
19	6952.5	203 06 57.7	+2 43 08.7	0.721 7782	203.06778	1.60903	-0.23
21	6954.5	206 20 03.1	2 36 02.9	.722 0409	206.28467	.60786	.24
23	6956.5	209 32 57.8	2 28 27.8	.722 3075	209.49920	.60667	.24
25	6958.5	212 45 41.7	2 20 25.2	.722 5772	212.71135	.60547	.23
27	6960.5	215 58 14.7	2 11 56.5	.722 8492	215.92109	.60427	.23
29	6962.5	219 10 36.6	+2 03 03.4	0.723 1226	219.12841	1.60306	-0.23
31	6964.5	222 22 47.7	1 53 47.7	.723 3965	222.33331	.60184	.23
Feb. 2	6966.5	225 34 48.0	1 44 11.0	.723 6701	225.53578	.60063	.23
4	6968.5	228 46 37.5	1 34 15.4	.723 9425	228.73583	.59943	.24
6	6970.5	231 58 16.7	1 24 02.6	.724 2129	231.93349	.59823	.24
8	6972.5	235 09 45.6	+1 13 34.7	0.724 4805	235.12877	1.59705	-0.23
10	6974.5	238 21 04.5	1 02 53.5	.724 7444	238.32171	.59589	.22
12	6976.5	241 32 13.9	0 52 01.2	.725 0037	241.51235	.59475	.22
14	6978.5	244 43 14.0	0 40 59.6	.725 2578	244.70073	.59363	.21
16	6980.5	247 54 05.4	0 29 51.0	.725 5058	247.88690	.59255	.20
18	6982.5	251 04 48.3	+0 18 37.2	0.725 7470	251.07093	1.59148	-0.18
20	6984.5	254 15 23.4	+0 07 20.5	.725 9806	254.25286	.59046	.17
22	6986.5	257 25 51.1	-0 03 57.1	.726 2059	257.43279	.58948	.15
24	6988.5	260 36 11.9	0 15 13.6	.726 4223	260.61079	.58853	.14
26	6990.5	263 46 26.4	0 26 26.9	.726 6290	263.78694	.58763	.12
28	6992.5	266 56 35.1	-0 37 35.0	0.726 8254	266.96133	1.58677	-0.11
Mar. 1	6994.5	270 06 38.7	0 48 35.9	.727 0110	270.13404	.58596	.10
3	6996.5	273 16 37.6	0 59 27.5	.727 1852	273.30519	.58520	.08
5	6998.5	276 26 32.5	1 10 07.9	.727 3475	276.47487	.58449	.07
7	7000.5	279 36 23.9	1 20 35.2	.727 4973	279.64319	.58384	.06
9	7002.5	282 46 12.4	-1 30 47.6	0.727 6341	282.81026	1.58324	-0.05
11	7004.5	285 55 58.7	1 40 43.1	.727 7577	285.97619	.58270	.04
13	7006.5	289 05 43.1	1 50 20.1	.727 8676	289.14111	.58223	.03
15	7008.5	292 15 26.4	1 59 36.7	.727 9635	292.30514	.58181	.02
17	7010.5	295 25 08.9	2 08 31.4	.728 0451	295.46839	.58145	-.01
19	7012.5	298 34 51.3	-2 17 02.6	0.728 1121	298.63099	1.58116	0.00
21	7014.5	301 44 34.0	2 25 08.6	.728 1643	301.79308	.58093	+ .01
23	7016.5	304 54 17.6	2 32 48.1	.728 2017	304.95477	.58077	.03
25	7018.5	308 04 02.3	2 39 59.7	.728 2240	308.11621	.58068	.04
27	7020.5	311 13 48.8	2 46 42.0	.728 2312	311.27752	.58064	.05
29	7022.5	314 23 37.3	-2 52 54.0	0.728 2232	314.43883	1.58068	+0.06
31	7024.5	317 33 28.3	-2 58 34.3	0.728 2002	317.60028	1.58078	+0.07

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	243						
Mar. 31	7024.5	317 33 28.3	-2 58 34.3	0.728 2002	317.60028	1.58078	+0.07
Apr. 2	7026.5	320 43 22.1	3 03 42.1	.728 1621	320.76199	.58094	.07
4	7028.5	323 53 19.1	3 08 16.4	.728 1091	323.92409	.58117	.08
6	7030.5	327 03 19.5	3 12 16.3	.728 0414	327.08672	.58147	.09
8	7032.5	330 13 23.6	3 15 41.0	.727 9591	330.25001	.58182	.10
10	7034.5	333 23 31.7	-3 18 30.0	0.727 8625	333.41406	1.58224	+0.11
12	7036.5	336 33 44.0	3 20 42.7	.727 7518	336.57903	.58273	.11
14	7038.5	339 44 00.8	3 22 18.6	.727 6275	339.74501	.58326	.12
16	7040.5	342 54 22.2	3 23 17.5	.727 4898	342.91213	.58387	.12
18	7042.5	346 04 48.3	3 23 39.0	.727 3393	346.08051	.58452	.12
20	7044.5	349 15 19.4	-3 23 23.2	0.727 1762	349.25026	1.58523	+0.13
22	7046.5	352 25 55.6	3 22 29.9	.727 0013	352.42148	.58599	.13
24	7048.5	355 36 37.0	3 20 59.3	.726 8149	355.59427	.58681	.14
26	7050.5	358 47 23.8	3 18 51.6	.726 6176	358.76874	.58767	.14
28	7052.5	1 58 16.0	3 16 07.2	.726 4101	1.94498	.58858	.14
30	7054.5	5 09 13.7	-3 12 46.5	0.726 1930	5.12309	1.58953	+0.14
May 2	7056.5	8 20 17.0	3 08 50.0	.725 9669	8.30313	.59052	.14
4	7058.5	11 31 26.1	3 04 18.4	.725 7326	11.48519	.59155	.15
6	7060.5	14 42 41.0	2 59 12.5	.725 4907	14.66934	.59261	.15
8	7062.5	17 54 01.8	2 53 33.2	.725 2419	17.85564	.59370	.15
10	7064.5	21 05 28.6	-2 47 21.4	0.724 9872	21.04416	1.59482	+0.14
12	7066.5	24 17 01.4	2 40 38.2	.724 7272	24.23495	.59597	.14
14	7068.5	27 28 40.4	2 33 24.8	.724 4627	27.42804	.59713	.13
16	7070.5	30 40 25.6	2 25 42.5	.724 1946	30.62348	.59832	.13
18	7072.5	33 52 17.1	2 17 32.7	.723 9237	33.82131	.59951	.12
20	7074.5	37 04 15.0	-2 08 56.9	0.723 6508	37.02154	1.60072	+0.11
22	7076.5	40 16 19.4	1 59 56.5	.723 3769	40.22419	.60193	.11
24	7078.5	43 28 30.5	1 50 33.3	.723 1027	43.42927	.60315	.10
26	7080.5	46 40 48.2	1 40 48.9	.722 8291	46.63678	.60436	.09
28	7082.5	49 53 12.6	1 30 45.1	.722 5569	49.84671	.60557	.08
30	7084.5	53 05 43.9	-1 20 23.8	0.722 2871	53.05906	1.60677	+0.07
June 1	7086.5	56 18 22.2	1 09 47.0	.722 0205	56.27379	.60796	.06
3	7088.5	59 31 07.5	0 58 56.5	.721 7579	59.49088	.60913	.05
5	7090.5	62 43 59.8	0 47 54.4	.721 5001	62.71029	.61028	.03
7	7092.5	65 56 59.3	0 36 42.8	.721 2481	65.93198	.61140	.02
9	7094.5	69 10 06.0	-0 25 23.8	0.721 0025	69.15588	1.61250	+0.01
11	7096.5	72 23 19.9	0 13 59.5	.720 7641	72.38196	.61357	+ .01
13	7098.5	75 36 41.0	-0 02 32.1	.720 5338	75.61014	.61460	.00
15	7100.5	78 50 09.3	+0 08 56.2	.720 3123	78.84033	.61559	- .01
17	7102.5	82 03 44.9	0 20 23.2	.720 1002	82.07248	.61655	.03
19	7104.5	85 17 27.6	+0 31 46.7	0.719 8983	85.30649	1.61746	-0.04
21	7106.5	88 31 17.3	0 43 04.6	.719 7072	88.54227	.61831	.06
23	7108.5	91 45 14.0	0 54 14.5	.719 5275	91.77971	.61912	.07
25	7110.5	94 59 17.5	1 05 14.4	.719 3597	95.01871	.61988	.08
27	7112.5	98 13 27.6	1 16 02.2	.719 2045	98.25918	.62058	.09
29	7114.5	101 27 44.2	+1 26 35.6	0.719 0624	101.50097	1.62121	-0.10
July 1	7116.5	104 42 06.9	+1 36 52.7	0.718 9338	104.74399	1.62180	-0.11

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
243							
July 1	7116.5	104 42 06.9	+1 36 52.7	0.718 9338	104.74399	1.62180	-0.11
3	7118.5	107 56 35.5	1 46 51.5	.718 8190	107.98811	.62231	.12
5	7120.5	111 11 09.6	1 56 29.9	.718 7185	111.23320	.62277	.13
7	7122.5	114 25 49.0	2 05 46.0	.718 6327	114.47913	.62315	.14
9	7124.5	117 40 33.2	2 14 38.2	.718 5617	117.72577	.62348	.15
11	7126.5	120 55 21.7	+2 23 04.5	0.718 5059	120.97299	1.62373	-0.16
13	7128.5	124 10 14.1	2 31 03.3	.718 4653	124.22063	.62391	.17
15	7130.5	127 25 09.9	2 38 33.1	.718 4402	127.46858	.62403	.17
17	7132.5	130 40 08.6	2 45 32.4	.718 4306	130.71668	.62406	.17
19	7134.5	133 55 09.5	2 51 59.7	.718 4364	133.96479	.62404	.18
21	7136.5	137 10 12.0	+2 57 54.0	0.718 4579	137.21279	1.62395	-0.18
23	7138.5	140 25 15.6	3 03 13.9	.718 4947	140.46052	.62377	.18
25	7140.5	143 40 19.6	3 07 58.4	.718 5469	143.70784	.62354	.18
27	7142.5	146 55 23.3	3 12 06.7	.718 6143	146.95462	.62323	.18
29	7144.5	150 10 25.9	3 15 37.9	.718 6966	150.20073	.62286	.18
31	7146.5	153 25 26.9	+3 18 31.4	0.718 7935	153.44602	1.62242	-0.18
Aug. 2	7148.5	156 40 25.6	3 20 46.6	.718 9048	156.69038	.62192	.17
4	7150.5	159 55 21.1	3 22 23.1	.719 0301	159.93366	.62135	.17
6	7152.5	163 10 12.8	3 23 20.6	.719 1689	163.17575	.62073	.17
8	7154.5	166 25 00.1	3 23 39.1	.719 3208	166.41654	.62005	.16
10	7156.5	169 39 42.3	+3 23 18.5	0.719 4854	169.65590	1.61930	-0.16
12	7158.5	172 54 18.6	3 22 18.8	.719 6621	172.89372	.61851	.16
14	7160.5	176 08 48.4	3 20 40.4	.719 8503	176.12989	.61766	.15
16	7162.5	179 23 11.3	3 18 23.7	.720 0495	179.36433	.61677	.14
18	7164.5	182 37 26.4	3 15 29.1	.720 2589	182.59693	.61583	.13
20	7166.5	185 51 33.4	+3 11 57.3	0.720 4779	185.82761	1.61485	-0.12
22	7168.5	189 05 31.8	3 07 49.1	.720 7058	189.05629	.61382	.11
24	7170.5	192 19 21.0	3 03 05.2	.720 9420	192.28288	.61276	.10
26	7172.5	195 33 00.6	2 57 46.8	.721 1855	195.50733	.61168	.09
28	7174.5	198 46 30.4	2 51 54.8	.721 4357	198.72958	.61056	.07
30	7176.5	201 59 49.9	+2 45 30.5	0.721 6917	201.94955	1.60941	-0.06
Sept. 1	7178.5	205 12 58.9	2 38 35.2	.721 9527	205.16722	.60825	.05
3	7180.5	208 25 57.3	2 31 10.2	.722 2180	208.38255	.60707	.04
5	7182.5	211 38 44.9	2 23 17.0	.722 4867	211.59550	.60588	.02
7	7184.5	214 51 21.5	2 14 57.2	.722 7578	214.80605	.60467	-.01
9	7186.5	218 03 47.2	+2 06 12.5	0.723 0307	218.01419	1.60347	0.00
11	7188.5	221 16 02.0	1 57 04.5	.723 3043	221.21991	.60225	+ .01
13	7190.5	224 28 05.9	1 47 34.9	.723 5780	224.42320	.60104	.03
15	7192.5	227 39 59.1	1 37 45.7	.723 8507	227.62406	.59983	.04
17	7194.5	230 51 41.8	1 27 38.8	.724 1217	230.82253	.59864	.06
19	7196.5	234 03 14.1	+1 17 15.9	0.724 3902	234.01861	1.59745	+0.07
21	7198.5	237 14 36.4	1 06 39.2	.724 6552	237.21234	.59628	.09
23	7200.5	240 25 49.0	0 55 50.5	.724 9160	240.40376	.59514	.10
25	7202.5	243 36 52.2	0 44 51.9	.725 1718	243.59290	.59401	.11
27	7204.5	246 47 46.5	0 33 45.5	.725 4217	246.77982	.59291	.12
29	7206.5	249 58 32.3	+0 22 33.3	0.725 6651	249.96457	1.59184	+0.14
Oct. 1	7208.5	253 09 10.0	+0 11 17.4	0.725 9011	253.14722	1.59081	+0.15

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
243							
Oct. 1	7208.5	253 09 10.0	+0 11 17.4	0.725 9011	253.14722	1.59081	+0.15
3	7210.5	256 19 40.2	-0 00 00.1	.726 1291	256.32784	.58981	.16
5	7212.5	259 30 03.3	0 11 17.3	.726 3484	259.50649	.58885	.17
7	7214.5	262 40 20.0	0 22 31.9	.726 5583	262.68328	.58794	.19
9	7216.5	265 50 30.7	0 33 42.1	.726 7581	265.85826	.58706	.20
11	7218.5	269 00 36.0	-0 44 45.7	0.726 9472	269.03156	1.58624	+0.21
13	7220.5	272 10 36.5	0 55 40.7	.727 1251	272.20325	.58546	.22
15	7222.5	275 20 32.7	1 06 25.3	.727 2913	275.37344	.58474	.23
17	7224.5	278 30 25.3	1 16 57.4	.727 4451	278.54223	.58407	.24
19	7226.5	281 40 14.9	1 27 15.2	.727 5863	281.70974	.58345	.25
21	7228.5	284 50 01.9	-1 37 16.9	0.727 7143	284.87608	1.58290	+0.26
23	7230.5	287 59 47.0	1 47 00.5	.727 8287	288.04136	.58239	.26
25	7232.5	291 09 30.7	1 56 24.4	.727 9292	291.20570	.58196	.27
27	7234.5	294 19 13.5	2 05 27.0	.728 0156	294.36923	.58159	.28
29	7236.5	297 28 56.0	2 14 06.5	.728 0875	297.53208	.58127	.29
31	7238.5	300 38 38.7	-2 22 21.5	0.728 1447	300.69436	1.58102	+0.29
Nov. 2	7240.5	303 48 22.0	2 30 10.5	.728 1870	303.85621	.58084	.29
4	7242.5	306 58 06.4	2 37 32.0	.728 2143	307.01775	.58072	.29
6	7244.5	310 07 52.3	2 44 24.7	.728 2266	310.17913	.58067	.29
8	7246.5	313 17 40.2	2 50 47.4	.728 2238	313.34046	.58067	.29
10	7248.5	316 27 30.4	-2 56 38.9	0.728 2059	316.50187	1.58075	+0.28
12	7250.5	319 37 23.3	3 01 58.2	.728 1730	319.66351	.58090	.28
14	7252.5	322 47 19.3	3 06 44.3	.728 1251	322.82550	.58110	.27
16	7254.5	325 57 18.6	3 10 56.3	.728 0624	325.98797	.58138	.27
18	7256.5	329 07 21.5	3 14 33.4	.727 9850	329.15105	.58171	.26
20	7258.5	332 17 28.3	-3 17 35.0	0.727 8933	332.31486	1.58211	+0.25
22	7260.5	335 27 39.3	3 20 00.4	.727 7874	335.47952	.58257	.24
24	7262.5	338 37 54.6	3 21 49.2	.727 6677	338.64517	.58309	.23
26	7264.5	341 48 14.5	3 23 01.1	.727 5346	341.81192	.58367	.22
28	7266.5	344 58 39.0	3 23 35.7	.727 3885	344.97988	.58430	.20
30	7268.5	348 09 08.5	-3 23 32.9	0.727 2297	348.14917	1.58499	+0.19
Dec. 2	7270.5	351 19 43.0	3 22 52.7	.727 0589	351.31989	.58574	.17
4	7272.5	354 30 22.7	3 21 35.1	.726 8764	354.49216	.58654	.15
6	7274.5	357 41 07.7	3 19 40.4	.726 6828	357.66607	.58738	.13
8	7276.5	0 51 58.1	3 17 08.8	.726 4788	0.84172	.58827	.11
10	7278.5	4 02 54.0	-3 14 00.7	0.726 2649	4.01919	1.58921	+0.09
12	7280.5	7 13 55.5	3 10 16.6	.726 0419	7.19858	.59019	.08
14	7282.5	10 25 02.7	3 05 57.2	.725 8103	10.37996	.59120	.06
16	7284.5	13 36 15.7	3 01 03.2	.725 5709	13.56341	.59225	.05
18	7286.5	16 47 34.5	2 55 35.5	.725 3244	16.74898	.59333	.03
20	7288.5	19 58 59.3	-2 49 34.9	0.725 0716	19.93676	1.59445	+0.01
22	7290.5	23 10 30.1	2 43 02.5	.724 8132	23.12678	.59558	-.02
24	7292.5	26 22 07.1	2 35 59.6	.724 5501	26.31909	.59674	.04
26	7294.5	29 33 50.2	2 28 27.2	.724 2831	29.51374	.59792	.06
28	7296.5	32 45 39.6	2 20 26.9	.724 0130	32.71077	.59911	.08
30	7298.5	35 57 35.4	-2 12 00.0	0.723 7406	35.91019	1.60031	-0.09
32	7300.5	39 09 37.7	-2 03 08.0	0.723 4668	39.11203	1.60152	-0.11

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
Jan. -1	6932.5	246° 47' 32".9	-0° 33' 27".8	1.506 792	246.80106	0.533 560	+0.36
3	6936.5	248 55 59.7	0 37 23.6	.501 572	248.94273	.537 278	.37
7	6940.5	251 05 20.4	0 41 17.9	.496 365	251.09932	.541 023	.37
11	6944.5	253 15 35.4	0 45 10.3	.491 177	253.27095	.544 794	.37
15	6948.5	255 26 45.1	0 49 00.4	.486 018	255.45770	.548 584	.38
19	6952.5	257 38 49.7	-0 52 47.8	1.480 894	257.65964	0.552 386	+0.38
23	6956.5	259 51 49.4	0 56 32.0	.475 813	259.87680	.556 196	.37
27	6960.5	262 05 44.1	1 00 12.7	.470 783	262.10921	.560 006	.37
31	6964.5	264 20 34.0	1 03 49.3	.465 813	264.35684	.563 810	.37
Feb. 4	6968.5	266 36 18.9	1 07 21.4	.460 909	266.61967	.567 601	.38
8	6972.5	268 52 58.6	-1 10 48.6	1.456 082	268.89762	0.571 370	+0.38
12	6976.5	271 10 32.7	1 14 10.3	.451 337	271.19059	.575 111	.38
16	6980.5	273 29 00.7	1 17 26.2	.446 685	273.49846	.578 816	.38
20	6984.5	275 48 22.1	1 20 35.7	.442 132	275.82106	.582 475	.38
24	6988.5	278 08 36.2	1 23 38.4	.437 687	278.15819	.586 080	.39
28	6992.5	280 29 42.2	-1 26 33.8	1.433 359	280.50962	0.589 626	+0.39
Mar. 3	6996.5	282 51 39.0	1 29 21.4	.429 154	282.87510	.593 100	.39
7	7000.5	285 14 25.7	1 32 00.8	.425 081	285.25431	.596 494	.39
11	7004.5	287 38 00.9	1 34 31.4	.421 148	287.64693	.599 797	.39
15	7008.5	290 02 23.4	1 36 52.9	.417 363	290.05256	.603 005	.39
19	7012.5	292 27 31.7	-1 39 04.9	1.413 732	292.47083	0.606 107	+0.39
23	7016.5	294 53 24.1	1 41 06.8	.410 263	294.90126	.609 089	.38
27	7020.5	297 19 58.9	1 42 58.3	.406 963	297.34338	.611 948	.38
31	7024.5	299 47 14.2	1 44 39.1	.403 839	299.79667	.614 675	.37
Apr. 4	7028.5	302 15 08.0	1 46 08.6	.400 898	302.26059	.617 258	.36
8	7032.5	304 43 38.2	-1 47 26.7	1.398 145	304.73453	0.619 687	+0.36
12	7036.5	307 12 42.4	1 48 33.0	.395 587	307.21788	.621 960	.35
16	7040.5	309 42 18.4	1 49 27.2	.393 228	309.70999	.624 068	.35
20	7044.5	312 12 23.6	1 50 09.2	.391 075	312.21019	.626 001	.35
24	7048.5	314 42 55.5	1 50 38.6	.389 132	314.71776	.627 754	.34
28	7052.5	317 13 51.3	-1 50 55.3	1.387 402	317.23197	0.629 318	+0.34
May 2	7056.5	319 45 08.3	1 50 59.2	.385 891	319.75205	.630 690	.33
6	7060.5	322 16 43.7	1 50 50.2	.384 601	322.27723	.631 866	.32
10	7064.5	324 48 34.5	1 50 28.2	.383 535	324.80671	.632 838	.31
14	7068.5	327 20 37.8	1 49 53.2	.382 696	327.33966	.633 606	.30
18	7072.5	329 52 50.5	-1 49 05.3	1.382 086	329.87528	0.634 167	+0.28
22	7076.5	332 25 09.6	1 48 04.5	.381 706	332.41271	.634 514	.27
26	7080.5	334 57 32.0	1 46 51.0	.381 556	334.95111	.634 651	.26
30	7084.5	337 29 54.6	1 45 24.9	.381 638	337.48963	.634 572	.24
June 3	7088.5	340 02 14.4	1 43 46.4	.381 951	340.02741	.634 285	.23
7	7092.5	342 34 28.2	-1 41 55.7	1.382 494	342.56363	0.633 790	+0.21
11	7096.5	345 06 33.0	1 39 53.2	.383 266	345.09745	.633 084	.20
15	7100.5	347 38 25.8	1 37 39.2	.384 266	347.62802	.632 167	.18
19	7104.5	350 10 03.7	1 35 14.0	.385 490	350.15452	.631 051	.16
23	7108.5	352 41 23.6	1 32 37.9	.386 937	352.67616	.629 735	.15
27	7112.5	355 12 22.8	-1 29 51.5	1.388 603	355.19214	0.628 225	+0.13
July 1	7116.5	357 42 58.5	-1 26 55.2	1.390 483	357.70171	0.626 527	+0.11

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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
July 1	7116.5	357 42 58.5	-1 26 55.2	1.390 483	357.70171	0.626 527	+0.11
5	7120.5	0 13 08.0	1 23 49.4	.392 575	0.20411	.624 645	.09
9	7124.5	2 42 48.8	1 20 34.7	.394 874	2.69864	.622 590	.07
13	7128.5	5 11 58.3	1 17 11.5	.397 374	5.18460	.620 363	.05
17	7132.5	7 40 34.2	1 13 40.4	.400 070	7.66133	.617 977	.03
21	7136.5	10 08 34.2	-1 10 02.0	1.402 956	10.12821	0.615 438	+0.01
25	7140.5	12 35 56.2	1 06 16.7	.406 026	12.58464	.612 753	- .01
29	7144.5	15 02 38.2	1 02 25.2	.409 274	15.03005	.609 931	.03
Aug. 2	7148.5	17 28 38.3	0 58 28.0	.412 693	17.46392	.606 985	.04
6	7152.5	19 53 54.7	0 54 25.7	.416 276	19.88577	.603 920	.06
10	7156.5	22 18 25.9	-0 50 18.8	1.420 016	22.29513	0.600 743	-0.08
14	7160.5	24 42 10.3	0 46 08.0	.423 905	24.69158	.597 465	.10
18	7164.5	27 05 06.6	0 41 53.8	.427 936	27.07473	.594 097	.12
22	7168.5	29 27 13.6	0 37 36.8	.432 101	29.44425	.590 649	.13
26	7172.5	31 48 30.1	0 33 17.4	.436 393	31.79982	.587 124	.15
30	7176.5	34 08 55.2	-0 28 56.2	1.440 802	34.14116	0.583 537	-0.17
Sept. 3	7180.5	36 28 28.1	0 24 33.8	.445 322	36.46804	.579 894	.19
7	7184.5	38 47 08.1	0 20 10.7	.449 943	38.78025	.576 205	.21
11	7188.5	41 04 54.6	0 15 47.3	.454 659	41.07763	.572 476	.22
15	7192.5	43 21 47.1	0 11 24.0	.459 461	43.36002	.568 716	.24
19	7196.5	45 37 45.2	-0 07 01.5	1.464 340	45.62733	0.564 934	-0.25
23	7200.5	47 52 48.7	-0 02 40.1	.469 288	47.87947	.561 135	.26
27	7204.5	50 06 57.4	+0 01 39.9	.474 298	50.11640	.557 329	.28
Oct. 1	7208.5	52 20 11.4	0 05 57.9	.479 362	52.33810	.553 521	.30
5	7212.5	54 32 30.6	0 10 13.6	.484 471	54.54458	.549 721	.32
9	7216.5	56 43 55.3	+0 14 26.6	1.489 617	56.73588	0.545 930	-0.33
13	7220.5	58 54 25.6	0 18 36.6	.494 794	58.91204	.542 155	.34
17	7224.5	61 04 01.8	0 22 43.4	.499 992	61.07315	.538 405	.35
21	7228.5	63 12 44.4	0 26 46.5	.505 206	63.21932	.534 684	.36
25	7232.5	65 20 33.7	0 30 45.7	.510 426	65.35066	.530 992	.38
29	7236.5	67 27 30.4	+0 34 40.7	1.515 647	67.46731	0.527 342	-0.39
Nov. 2	7240.5	69 33 35.0	0 38 31.3	.520 860	69.56945	.523 734	.40
6	7244.5	71 38 48.2	0 42 17.2	.526 060	71.65724	.520 171	.40
10	7248.5	73 43 10.7	0 45 58.3	.531 239	73.73089	.516 661	.41
14	7252.5	75 46 43.2	0 49 34.4	.536 391	75.79060	.513 202	.41
18	7256.5	77 49 26.5	+0 53 05.2	1.541 508	77.83658	0.509 800	-0.42
22	7260.5	79 51 21.6	0 56 30.5	.546 586	79.86908	.506 459	.43
26	7264.5	81 52 29.2	0 59 50.4	.551 617	81.88834	.503 183	.43
30	7268.5	83 52 50.4	1 03 04.5	.556 597	83.89463	.499 969	.43
Dec. 4	7272.5	85 52 26.0	1 06 12.8	.561 518	85.88818	.496 822	.43
8	7276.5	87 51 17.1	+1 09 15.2	1.566 376	87.86930	0.493 747	-0.44
12	7280.5	89 49 24.6	1 12 11.5	.571 165	89.83825	.490 741	.44
16	7284.5	91 46 49.6	1 15 01.7	.575 881	91.79533	.487 810	.44
20	7288.5	93 43 33.2	1 17 45.7	.580 517	93.74083	.484 954	.45
24	7292.5	95 39 36.5	1 20 23.4	.585 069	95.67506	.482 172	.45
28	7296.5	97 35 00.5	+1 22 54.8	1.589 532	97.59831	0.479 468	-0.44
32	7300.5	99 29 46.4	+1 25 19.8	1.593 903	99.51091	0.476 843	-0.44

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
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JUPITER

		243				
Jan.	-3	6930.5	254 39 15.1	+0 33 37.7	5.315 207	254.64843 0.079 561
	7	6940.5	255 27 00.6	0 32 38.5	.311 967	255.44452 .079 658
	17	6950.5	256 14 49.5	0 31 38.8	.308 704	256.24159 .079 756
	27	6960.5	257 02 42.0	0 30 38.7	.305 417	257.03964 .079 855
Feb.	6	6970.5	257 50 38.0	0 29 38.2	.302 108	257.83869 .079 955
	16	6980.5	258 38 37.7	+0 28 37.3	5.298 776	258.63874 0.080 056
	26	6990.5	259 26 41.0	0 27 35.9	.295 424	259.43980 .080 158
Mar.	7	7000.5	260 14 47.9	0 26 34.1	.292 050	260.24188 .080 260
	17	7010.5	261 02 58.5	0 25 32.0	.288 657	261.04499 .080 363
	27	7020.5	261 51 12.8	0 24 29.5	.285 244	261.84914 .080 467
Apr.	6	7030.5	262 39 30.9	+0 23 26.6	5.281 812	262.65433 0.080 572
	16	7040.5	263 27 52.7	0 22 23.3	.278 363	263.46057 .080 677
	26	7050.5	264 16 18.3	0 21 19.7	.274 896	264.26787 .080 783
May	6	7060.5	265 04 47.8	0 20 15.7	.271 412	265.07623 .080 890
	16	7070.5	265 53 21.1	0 19 11.4	.267 912	265.88567 .080 998
	26	7080.5	266 41 58.3	+0 18 06.8	5.264 397	266.69618 0.081 106
June	5	7090.5	267 30 39.4	0 17 01.9	.260 867	267.50778 .081 215
	15	7100.5	268 19 24.4	0 15 56.8	.257 323	268.32048 .081 325
	25	7110.5	269 08 13.4	0 14 51.3	.253 765	269.13427 .081 435
July	5	7120.5	269 57 06.3	0 13 45.6	.250 195	269.94917 .081 546
	15	7130.5	270 46 03.2	+0 12 39.6	5.246 613	270.76518 0.081 657
	25	7140.5	271 35 04.2	0 11 33.3	.243 020	271.58231 .081 769
Aug.	4	7150.5	272 24 09.1	0 10 26.8	.239 417	272.40057 .081 882
	14	7160.5	273 13 18.2	0 09 20.1	.235 804	273.21995 .081 995
	24	7170.5	274 02 31.3	0 08 13.2	.232 182	274.04047 .082 109
Sept.	3	7180.5	274 51 48.5	+0 07 06.2	5.228 552	274.86212 0.082 223
	13	7190.5	275 41 09.8	0 05 58.9	.224 914	275.68492 .082 337
	23	7200.5	276 30 35.2	0 04 51.5	.221 269	276.50887 .082 452
Oct.	3	7210.5	277 20 04.8	0 03 43.9	.217 619	277.33397 .082 568
	13	7220.5	278 09 38.6	0 02 36.1	.213 963	278.16023 .082 684
	23	7230.5	278 59 16.5	+0 01 28.3	5.210 303	278.98765 0.082 800
Nov.	2	7240.5	279 48 58.6	+0 00 20.3	.206 639	279.81623 .082 917
	12	7250.5	280 38 45.0	-0 00 47.8	.202 972	280.64598 .083 034
	22	7260.5	281 28 35.5	0 01 56.0	.199 303	281.47690 .083 151
Dec.	2	7270.5	282 18 30.3	0 03 04.2	.195 632	282.30900 .083 268
	12	7280.5	283 08 29.3	-0 04 12.5	5.191 961	283.14227 0.083 386
	22	7290.5	283 58 32.5	0 05 20.8	.188 290	283.97672 .083 504
	32	7300.5	284 48 40.0	-0 06 29.2	5.184 620	284.81235 0.083 623

URANUS

Dec.	18	6920.5	138 20 59.8	+0 41 52.3	18.406 62	138.35196 0.012 7600
Jan.	27	6960.5	138 51 37.7	0 42 02.9	.402 49	138.86245 .012 7646
Mar.	7	7000.5	139 22 16.2	0 42 13.2	.398 43	139.37313 .012 7691
Apr.	16	7040.5	139 52 55.4	0 42 23.3	.394 43	139.88398 .012 7735
May	26	7080.5	140 23 35.2	0 42 33.2	.390 50	140.39501 .012 7779
July	5	7120.5	140 54 15.7	+0 42 42.9	18.386 63	140.90621 0.012 7821
Aug.	14	7160.5	141 24 56.7	0 42 52.4	.382 82	141.41758 .012 7864
Sept.	23	7200.5	141 55 38.4	0 43 01.7	.379 09	141.92912 .012 7906
Nov.	2	7240.5	142 26 20.7	0 43 10.9	.375 41	142.44083 .012 7949
Dec.	12	7280.5	142 57 03.5	0 43 19.8	.371 81	142.95271 .012 7989
Jan.	21	7320.5	143 27 47.0	+0 43 28.5	18.368 27	143.46474 0.012 8029

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
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SATURN						
Jan.	-3	²⁴³ 6930.5	279° 19' 54".2	+0° 36' 05".0	10.062 721	279.31906 0.030 130
	7	6940.5	279 37 58.1	0 35 19.3	.062 365	279.62038 .030 132
	17	6950.5	279 56 02.0	0 34 33.6	.061 992	279.92172 .030 135
	27	6960.5	280 14 06.0	0 33 47.8	.061 603	280.22308 .030 137
Feb.	6	6970.5	280 32 10.0	0 33 01.9	.061 197	280.52447 .030 140
	16	6980.5	280 50 14.2	+0 32 16.0	10.060 775	280.82588 0.030 142
	26	6990.5	281 08 18.5	0 31 30.1	.060 337	281.12732 .030 145
Mar.	7	7000.5	281 26 22.8	0 30 44.1	.059 882	281.42878 .030 148
	17	7010.5	281 44 27.2	0 29 58.0	.059 411	281.73027 .030 151
	27	7020.5	282 02 31.8	0 29 11.9	.058 923	282.03180 .030 154
Apr.	6	7030.5	282 20 36.4	+0 28 25.7	10.058 418	282.33335 0.030 157
	16	7040.5	282 38 41.2	0 27 39.4	.057 897	282.63493 .030 160
	26	7050.5	282 56 46.0	0 26 53.2	.057 360	282.93654 .030 163
May	6	7060.5	283 14 51.0	0 26 06.8	.056 806	283.23819 .030 166
	16	7070.5	283 32 56.1	0 25 20.4	.056 236	283.53987 .030 170
	26	7080.5	283 51 01.3	+0 24 34.0	10.055 648	283.84159 0.030 173
June	5	7090.5	284 09 06.6	0 23 47.5	.055 045	284.14334 .030 177
	15	7100.5	284 27 12.1	0 23 01.0	.054 425	284.44513 .030 180
	25	7110.5	284 45 17.7	0 22 14.5	.053 789	284.74696 .030 184
July	5	7120.5	285 03 23.4	0 21 27.9	.053 135	285.04882 .030 188
	15	7130.5	285 21 29.3	+0 20 41.2	10.052 466	285.35072 0.030 192
	25	7140.5	285 39 35.3	0 19 54.5	.051 780	285.65267 .030 196
Aug.	4	7150.5	285 57 41.5	0 19 07.8	.051 077	285.95465 .030 201
	14	7160.5	286 15 47.8	0 18 21.0	.050 358	286.25668 .030 205
	24	7170.5	286 33 54.2	0 17 34.2	.049 623	286.55875 .030 209
Sept.	3	7180.5	286 52 00.9	+0 16 47.4	10.048 871	286.86087 0.030 214
	13	7190.5	287 10 07.7	0 16 00.5	.048 102	287.16303 .030 218
	23	7200.5	287 28 14.6	0 15 13.6	.047 317	287.46524 .030 223
Oct.	3	7210.5	287 46 21.7	0 14 26.7	.046 516	287.76750 .030 228
	13	7220.5	288 04 29.0	0 13 39.7	.045 698	288.06980 .030 233
	23	7230.5	288 22 36.5	+0 12 52.7	10.044 864	288.37215 0.030 238
Nov.	2	7240.5	288 40 44.1	0 12 05.7	.044 013	288.67456 .030 243
	12	7250.5	288 58 52.0	0 11 18.6	.043 146	288.97702 .030 248
	22	7260.5	289 17 00.0	0 10 31.5	.042 262	289.27952 .030 253
Dec.	2	7270.5	289 35 08.2	0 09 44.4	.041 362	289.58209 .030 259
	12	7280.5	289 53 16.6	+0 08 57.3	10.040 445	289.88471 0.030 264
	22	7290.5	290 11 25.2	0 08 10.1	.039 512	290.18738 .030 270
	32	7300.5	290 29 34.0	+0 07 23.0	10.038 563	290.49011 0.030 275

NEPTUNE						
Dec.	18	6920.5	216 59 19.1	+1 46 05.6	30.331 18	216.99071 0.005 9302
Jan.	27	6960.5	217 13 33.4	1 46 07.5	.331 11	217.22790 .005 9295
Mar.	7	7000.5	217 27 47.6	1 46 09.3	.331 02	217.46507 .005 9289
Apr.	16	7040.5	217 42 01.7	1 46 11.0	.330 92	217.70221 .005 9284
May	26	7080.5	217 56 15.8	1 46 12.6	.330 81	217.93934 .005 9279
July	5	7120.5	218 10 29.7	+1 46 14.0	30.330 68	218.17644 0.005 9272
Aug.	14	7160.5	218 24 43.6	1 46 15.4	.330 54	218.41352 .005 9266
Sept.	23	7200.5	218 38 57.4	1 46 16.7	.330 39	218.65057 .005 9259
Nov.	2	7240.5	218 53 11.1	1 46 17.8	.330 22	218.88759 .005 9253
Dec.	12	7280.5	219 07 24.7	1 46 18.8	.330 04	219.12459 .005 9248
Jan.	21	7320.5	219 21 38.2	+1 46 19.8	30.329 85	219.36157 0.005 9240

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
Nov. 8	²⁴³ 6880.5	⁰ 154 19 17.6	⁺¹² 12 31.1	33.86615	¹⁵⁵ 62668	⁰ 0.005 2724
Jan. 27	6960.5	154 44 37.9	12 17 47.7	.81344	156.04905	.005 2869
Apr. 16	7040.5	155 10 03.6	12 23 03.0	.76090	156.47258	.005 3013
July 5	7120.5	155 35 34.6	12 28 16.9	.70854	156.89726	.005 3157
Sept. 23	7200.5	156 01 10.9	+12 33 29.4	33.65637	157.32309	0.005 3301
Dec. 12	7280.5	156 26 52.6	12 38 40.4	.60440	157.75008	.005 3446
Mar. 2	7360.5	156 52 39.7	+12 43 49.8	33.55264	158.17823	0.005 3590

INNER PLANETS
MEAN ELEMENTS
MEAN EQUINOX AND ECLIPTIC OF DATE

Planet	Epoch 1960 Sept. 23.0 = J.D. 243 7200.5 ; variations for 100 days					
	Inclination	Longitude of		Mean Distance	Mean Motion	Eccentricity
	<i>i</i> Var.	Ascending Node Ω	Perihelion ω Var.	<i>a</i>	<i>n</i>	<i>e</i>
Mercury	⁰ 7.00400 +1	⁰ 47.86575 +325	⁰ 76.84441 +426	0.387 099	⁰ .4.092 339	0.205 627
Venus	3.39424 0	76.32625 +247	131.01853 +385	0.723 332	1.602 130	0.006 792
Mars	1.84993 0	49.25464 +211	335.33609 +504	1.523 691	0.524 033	0.093 369

Date	Julian Date	Mean Anomalies			Date	Julian Date	Mean Anomalies		
		Mercury	Venus	Mars			Mercury	Venus	Mars
Jan. -3	²⁴³ 6930.5	¹²⁷ 373	³⁶ 076	²⁸¹ 086	July 5	²⁴³ 7120.5	¹⁸⁴ 917	³⁴⁰ 481	²⁰ 650
7	6940.5	168.296	52.098	286.327	15	7130.5	225.840	356.502	25.891
17	6950.5	209.220	68.119	291.567	25	7140.5	266.763	12.524	31.131
27	6960.5	250.143	84.140	296.807	Aug. 4	7150.5	307.687	28.545	36.371
Feb. 6	6970.5	291.066	100.162	302.047	14	7160.5	348.610	44.566	41.611
16	6980.5	331.990	116.183	307.288	24	7170.5	29.533	60.588	46.851
26	6990.5	12.913	132.204	312.528	Sept. 3	7180.5	70.457	76.609	52.092
Mar. 7	7000.5	53.836	148.226	317.768	13	7190.5	111.380	92.630	57.332
17	7010.5	94.760	164.247	323.008	23	7200.5	152.303	108.652	62.572
27	7020.5	135.683	180.268	328.248	Oct. 3	7210.5	193.227	124.673	67.812
Apr. 6	7030.5	176.606	196.289	333.489	13	7220.5	234.150	140.694	73.053
16	7040.5	217.530	212.311	338.729	23	7230.5	275.073	156.715	78.293
26	7050.5	258.453	228.332	343.969	Nov. 2	7240.5	315.997	172.737	83.533
May 6	7060.5	299.377	244.353	349.209	12	7250.5	356.920	188.758	88.773
16	7070.5	340.300	260.375	354.449	22	7260.5	37.843	204.779	94.013
26	7080.5	21.223	276.396	359.690	Dec. 2	7270.5	78.767	220.801	99.254
June 5	7090.5	62.147	292.417	4.930	12	7280.5	119.690	236.822	104.494
15	7100.5	103.070	308.439	10.170	22	7290.5	160.613	252.843	109.734
25	7110.5	143.993	324.460	15.410	32	7300.5	201.537	268.865	114.974

OSCULATING ELEMENTS
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Inclin- ation <i>i</i>	Longitude of		Mean Distance <i>a</i>	Mean Motion <i>n</i>	Eccen- tricity <i>e</i>	Mean Anomaly
			Asc. Node Ω	Perihelion ϖ				

JUPITER

	243							
Jan. 27	6960.5	1.30641	100.0560	12.3279	5.208 041	0.082 9263	0.048 3351	249.7967
Mar. 7	7000.5	1.30639	100.0571	12.2886	.208 149	.082 9238	.048 3719	253.1601
Apr. 16	7040.5	1.30637	100.0582	12.2524	.208 256	.082 9212	.048 4099	256.5201
May 26	7080.5	1.30636	100.0593	12.2197	.208 361	.082 9187	.048 4491	259.8763
July 5	7120.5	1.30634	100.0604	12.1909	.208 462	.082 9163	.048 4893	263.2285
Aug. 14	7160.5	1.30632	100.0614	12.1663	5.208 557	0.082 9140	0.048 5304	266.5763
Sept. 23	7200.5	1.30631	100.0623	12.1464	.208 645	.082 9119	.048 5722	269.9192
Nov. 2	7240.5	1.30629	100.0633	12.1314	.208 724	.082 9100	.048 6145	273.2571
Dec. 12	7280.5	1.30627	100.0642	12.1218	5.208 792	0.082 9084	0.048 6571	276.5894

SATURN

Jan. 27	6960.5	2.48722	113.3161	92.1031	9.582 589	0.033 2261	0.050 5484	188.9699
Mar. 7	7000.5	2.48721	113.3174	91.9523	.582 671	.033 2257	.050 5624	190.4673
Apr. 16	7040.5	2.48720	113.3187	91.7975	.582 728	.033 2254	.050 5833	191.9693
May 26	7080.5	2.48719	113.3199	91.6390	.582 767	.033 2252	.050 6110	193.4755
July 5	7120.5	2.48718	113.3212	91.4770	.582 791	.033 2251	.050 6449	194.9857
Aug. 14	7160.5	2.48718	113.3224	91.3120	9.582 807	0.033 2250	0.050 6847	196.4994
Sept. 23	7200.5	2.48718	113.3236	91.1443	.582 819	.033 2249	.050 7299	198.0162
Nov. 2	7240.5	2.48718	113.3248	90.9744	.582 834	.033 2249	.050 7799	199.5356
Dec. 12	7280.5	2.48718	113.3261	90.8029	9.582 855	0.033 2248	0.050 8343	201.0570

URANUS

Jan. 27	6960.5	0.77236	73.7218	172.5311	19.16306	0.011 7492	0.046 9065	329.2259
Mar. 7	7000.5	0.77234	73.7183	172.6049	.15931	.011 7526	.046 7234	329.6183
Apr. 16	7040.5	0.77232	73.7149	172.6700	.15564	.011 7560	.046 5408	330.0190
May 26	7080.5	0.77230	73.7117	172.7259	.15206	.011 7593	.046 3592	330.4286
July 5	7120.5	0.77228	73.7088	172.7724	.14857	.011 7625	.046 1792	330.8472
Aug. 14	7160.5	0.77227	73.7060	172.8091	19.14519	0.011 7656	0.046 0013	331.2751
Sept. 23	7200.5	0.77225	73.7034	172.8359	.14193	.011 7686	.045 8261	331.7128
Nov. 2	7240.5	0.77224	73.7010	172.8524	.13879	.011 7715	.045 6541	332.1603
Dec. 12	7280.5	0.77223	73.6989	172.8584	19.13579	0.011 7743	0.045 4860	332.6179

NEPTUNE

Jan. 27	6960.5	1.77329	131.3233	25.9372	30.23803	0.005 9275	0.003 1394	191.3613
Mar. 7	7000.5	1.77329	131.3285	24.7505	.23243	.005 9292	.003 3437	192.7991
Apr. 16	7040.5	1.77328	131.3337	23.8246	.22651	.005 9309	.003 5590	193.9757
May 26	7080.5	1.77328	131.3390	23.1271	.22027	.005 9328	.003 7843	194.9234
July 5	7120.5	1.77328	131.3443	22.6287	.21374	.005 9347	.004 0188	195.6716
Aug. 14	7160.5	1.77327	131.3496	22.3034	30.20691	0.005 9367	0.004 2617	196.2460
Sept. 23	7200.5	1.77327	131.3549	22.1279	.19980	.005 9388	.004 5121	196.6702
Nov. 2	7240.5	1.77327	131.3603	22.0821	.19242	.005 9410	.004 7695	196.9641
Dec. 12	7280.5	1.77326	131.3656	22.1483	30.18480	0.005 9432	0.005 0331	197.1453

PLUTO

Jan. 27	6960.5	17.16644	109.8642	223.8342	39.52392	0.003 9665	0.251 3552	316.8710
Apr. 16	7040.5	17.16788	109.8724	223.9483	.49551	.003 9709	.251 0058	317.0735
July 5	7120.5	17.16903	109.8795	224.0573	.46706	.003 9752	.250 6321	317.2782
Sept. 23	7200.5	17.16987	109.8856	224.1597	.43886	.003 9794	.250 2376	317.4867
Dec. 12	7280.5	17.17039	109.8906	224.2542	39.41123	0.003 9836	0.249 8262	317.7002

MERCURY, 1960

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	"	"		^h ^m ^s
Jan. 0	17 31 32.38	-23 19 57.4	2.52	6.65	1.323 600	10 57 59
1	17 38 00.05	23 31 06.1	2.50	6.60	.333 905	11 00 32
2	17 44 30.74	23 41 07.7	2.49	6.55	.343 629	11 03 08
3	17 51 04.27	23 50 00.4	2.47	6.51	.352 782	11 05 46
4	17 57 40.48	23 57 42.3	2.45	6.46	.361 371	11 08 27
5	18 04 19.21	-24 04 11.8	2.44	6.43	1.369 404	11 11 11
6	18 11 00.31	24 09 27.4	2.43	6.39	.376 890	11 13 57
7	18 17 43.65	24 13 27.8	2.41	6.36	.383 833	11 16 45
8	18 24 29.07	24 16 11.6	2.40	6.33	.390 240	11 19 35
9	18 31 16.47	24 17 37.4	2.39	6.30	.396 115	11 22 27
10	18 38 05.71	-24 17 44.1	2.38	6.28	1.401 460	11 25 21
11	18 44 56.67	24 16 30.6	2.38	6.26	.406 280	11 28 17
12	18 51 49.25	24 13 55.7	2.37	6.24	.410 574	11 31 14
13	18 58 43.31	24 09 58.4	2.36	6.22	.414 345	11 34 12
14	19 05 38.76	24 04 37.8	2.36	6.21	.417 590	11 37 12
15	19 12 35.48	-23 57 52.9	2.35	6.20	1.420 308	11 40 13
16	19 19 33.37	23 49 42.8	2.35	6.19	.422 497	11 43 16
17	19 26 32.33	23 40 06.6	2.35	6.18	.424 152	11 46 19
18	19 33 32.25	23 29 03.6	2.34	6.17	.425 268	11 49 23
19	19 40 33.02	23 16 33.0	2.34	6.17	.425 838	11 52 28
20	19 47 34.56	-23 02 34.0	2.34	6.17	1.425 853	11 55 34
21	19 54 36.77	22 47 06.0	2.34	6.17	.425 305	11 58 40
22	20 01 39.53	22 30 08.4	2.35	6.18	.424 182	12 01 47
23	20 08 42.76	22 11 40.6	2.35	6.19	.422 471	12 04 54
24	20 15 46.35	21 51 42.2	2.35	6.20	.420 159	12 08 02
25	20 22 50.19	-21 30 12.8	2.36	6.21	1.417 229	12 11 10
26	20 29 54.17	21 07 12.0	2.36	6.22	.413 664	12 14 18
27	20 36 58.18	20 42 39.6	2.37	6.24	.409 445	12 17 25
28	20 44 02.08	20 16 35.4	2.38	6.27	.404 549	12 20 33
29	20 51 05.76	19 48 59.5	2.39	6.29	.398 955	12 23 40
30	20 58 09.05	-19 19 52.0	2.40	6.32	1.392 638	12 26 47
31	21 05 11.82	18 49 13.3	2.41	6.35	.385 570	12 29 53
Feb. 1	21 12 13.88	18 17 03.7	2.42	6.39	.377 724	12 32 59
2	21 19 15.04	17 43 24.2	2.44	6.43	.369 070	12 36 03
3	21 26 15.09	17 08 15.6	2.46	6.47	.359 576	12 39 07
4	21 33 13.76	-16 31 39.5	2.48	6.52	1.349 209	12 42 08
5	21 40 10.76	15 53 37.7	2.50	6.58	.337 935	12 45 08
6	21 47 05.76	15 14 12.3	2.52	6.64	.325 718	12 48 06
7	21 53 58.35	14 33 26.4	2.54	6.70	.312 526	12 51 01
8	22 00 48.06	13 51 23.3	2.57	6.78	.298 324	12 53 52
9	22 07 34.37	-13 08 07.4	2.60	6.86	1.283 079	12 56 40
10	22 14 16.62	12 23 43.8	2.64	6.95	.266 764	12 59 24
11	22 20 54.10	11 38 18.9	2.67	7.04	.249 353	13 02 02
12	22 27 25.95	10 51 59.9	2.71	7.15	.230 829	13 04 34
13	22 33 51.19	10 04 55.5	2.76	7.27	.211 182	13 06 59
14	22 40 08.71	-9 17 15.7	2.81	7.39	1.190 413	13 09 15
15	22 46 17.26	-8 29 12.3	2.86	7.53	1.168 535	13 11 22

MERCURY, 1960
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	22 46 17.26 +358.13	- 8 29 12.3 +2893.8	2.86	7.53	1.168 535 -22 958	13 11 22
16	22 52 15.39 346.17	7 40 58.5 +2889.4	2.92	7.68	.145 577 23 990	13 13 18
17	22 58 01.56 332.46	6 52 49.1 +2868.2	2.98	7.85	.121 587 24 958	13 15 00
18	23 03 34.02 316.89	6 05 00.9 +2828.8	3.05	8.02	.096 629 25 836	13 16 28
19	23 08 50.91 299.33	5 17 52.1 +2769.5	3.12	8.22	.070 793 26 605	13 17 39
20	23 13 50.24 +279.68	- 4 31 42.6 +2689.1	3.20	8.43	1.044 188 -27 242	13 18 31
21	23 18 29.92 257.92	3 46 53.5 +2586.4	3.28	8.65	1.016 946 27 724	13 19 02
22	23 22 47.84 233.99	3 03 47.1 +2460.9	3.38	8.90	0.989 222 28 034	13 19 10
23	23 26 41.83 207.99	2 22 46.2 +2311.9	3.47	9.16	.961 188 28 153	13 18 54
24	23 30 09.82 180.00	1 44 14.3 +2139.8	3.58	9.43	.933 035 28 071	13 18 10
25	23 33 09.82 +150.22	- 1 08 34.5 +1945.1	3.69	9.72	0.904 964 -27 777	13 16 57
26	23 35 40.04 118.88	0 36 09.4 +1728.7	3.81	10.03	.877 187 27 270	13 15 14
27	23 37 38.92 86.34	- 0 07 20.7 +1492.2	3.93	10.35	.849 917 26 549	13 12 58
28	23 39 05.26 52.97	+ 0 17 31.5 +1237.8	4.06	10.69	.823 368 25 622	13 10 10
29	23 39 58.23 +19.25	0 38 09.3 +968.1	4.19	11.03	.797 746 24 496	13 06 49
Mar. 1	23 40 17.48 -14.27	+ 0 54 17.4 +686.3	4.32	11.38	0.773 250 -23 185	13 02 54
2	23 40 03.21 47.01	1 05 43.7 +396.4	4.45	11.73	.750 065 21 708	12 58 26
3	23 39 16.20 78.32	1 12 20.1 +102.9	4.59	12.08	.728 357 20 080	12 53 26
4	23 37 57.88 107.53	1 14 03.0 -188.8	4.72	12.42	.708 277 18 327	12 47 57
5	23 36 10.35 133.98	1 10 54.2 +473.2	4.84	12.75	.689 950 16 468	12 42 00
6	23 33 56.37 -157.05	+ 1 03 01.0 -744.5	4.96	13.07	0.673 482 -14 532	12 35 38
7	23 31 19.32 176.20	0 50 36.5 +996.4	5.07	13.35	.658 950 12 541	12 28 56
8	23 28 23.12 190.96	0 34 00.1 +1223.1	5.17	13.61	.646 409 10 524	12 21 57
9	23 25 12.16 201.07	+ 0 13 37.0 +1419.8	5.25	13.84	.635 885 8 505	12 14 46
10	23 21 51.09 206.37	- 0 10 02.8 +1582.3	5.32	14.03	.627 380 6 510	12 07 27
11	23 18 24.72 -206.88	- 0 36 25.1 -1708.0	5.38	14.17	0.620 870 -4 562	12 00 06
12	23 14 57.84 202.82	1 04 53.1 +1795.3	5.42	14.28	.616 308 2 683	11 52 46
13	23 11 35.02 194.54	1 34 48.4 +1845.0	5.44	14.34	.613 625 -887	11 45 32
14	23 08 20.48 182.49	2 05 33.4 +1858.1	5.45	14.36	.612 738 +807	11 38 29
15	23 05 17.99 167.23	2 36 31.5 +1837.7	5.44	14.34	.613 545 2 390	11 31 39
16	23 02 30.76 -149.34	- 3 07 09.2 -1787.6	5.42	14.29	0.615 935 +3 858	11 25 05
17	23 00 01.42 129.43	3 36 56.8 +1711.6	5.39	14.20	.619 793 5 204	11 18 50
18	22 57 51.99 108.04	4 05 28.4 +1614.1	5.34	14.08	.624 997 6 430	11 12 55
19	22 56 03.95 85.74	4 32 22.5 +1499.7	5.29	13.94	.631 427 7 536	11 07 22
20	22 54 38.21 62.95	4 57 22.2 +1372.0	5.23	13.77	.638 963 8 529	11 02 12
21	22 53 35.26 -40.09	- 5 20 14.2 -1234.8	5.16	13.59	0.647 492 +9 414	10 57 23
22	22 52 55.17 -17.48	5 40 49.0 +1091.2	5.08	13.40	.656 906 10 196	10 52 58
23	22 52 37.69 +4.62	5 59 00.2 +943.8	5.01	13.19	.667 102 10 887	10 48 55
24	22 52 42.31 26.03	6 14 44.0 +794.8	4.93	12.98	.677 989 11 491	10 45 13
25	22 53 08.34 46.62	6 27 58.8 +645.7	4.84	12.76	.689 480 12 018	10 41 52
26	22 53 54.96 +66.27	- 6 38 44.5 -498.1	4.76	12.54	0.701 498 +12 474	10 38 52
27	22 55 01.23 84.96	6 47 02.6 +352.8	4.68	12.33	.713 972 12 869	10 36 10
28	22 56 26.19 102.62	6 52 55.4 +210.4	4.60	12.11	.726 841 13 206	10 33 47
29	22 58 08.81 119.31	6 56 25.8 -71.7	4.51	11.89	.740 047 13 497	10 31 40
30	23 00 08.12 135.00	6 57 37.5 +63.2	4.43	11.68	.753 544 13 741	10 29 50
31	23 02 23.12 +149.75	- 6 56 34.3 +194.1	4.35	11.47	0.767 285 +13 948	10 28 15
Apr. 1	23 04 52.87	- 6 53 20.2	4.28	11.26	0.781 233	10 26 55

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	23 04 52.87 ^s +163.60	- 6 53 20.2 ^s + 320.9	4.28	11.26	0.781 233 ^s +14 122	10 26 55
2	23 07 36.47 176.58	6 47 59.3 ^s 443.6	4.20	11.06	.795 355 14 265	10 25 48
3	23 10 33.05 188.76	6 40 35.7 562.3	4.13	10.87	.809 620 14 384	10 24 53
4	23 13 41.81 200.20	6 31 13.4 677.1	4.05	10.68	.824 004 14 479	10 24 10
5	23 17 02.01 210.94	6 19 56.3 788.0	3.98	10.50	.838 483 14 555	10 23 39
6	23 20 32.95 +221.06	- 6 06 48.3 ^s + 895.4	3.92	10.32	0.853 038 +14 613	10 23 17
7	23 24 14.01 230.56	5 51 52.9 999.1	3.85	10.14	.867 651 14 657	10 23 06
8	23 28 04.57 239.57	5 35 13.8 1099.6	3.79	9.97	.882 308 14 688	10 23 04
9	23 32 04.14 248.09	5 16 54.2 1196.8	3.72	9.81	.896 996 14 706	10 23 11
10	23 36 12.23 256.17	4 56 57.4 1290.9	3.66	9.65	.911 702 14 714	10 23 26
11	23 40 28.40 +263.90	- 4 35 26.5 ^s +1382.1	3.61	9.50	0.926 416 +14 712	10 23 49
12	23 44 52.30 271.29	4 12 24.4 1470.5	3.55	9.35	.941 128 14 702	10 24 20
13	23 49 23.59 278.37	3 47 53.9 1556.3	3.49	9.21	.955 830 14 683	10 24 58
14	23 54 01.96 285.23	3 21 57.6 1639.4	3.44	9.07	.970 513 14 656	10 25 42
15	23 58 47.19 291.85	2 54 38.2 1720.0	3.39	8.93	.985 169 14 621	10 26 34
16	0 03 39.04 +298.31	- 2 25 58.2 ^s +1798.1	3.34	8.80	0.999 790 +14 577	10 27 32
17	0 08 37.35 304.63	1 56 00.1 1874.0	3.29	8.68	1.014 367 14 525	10 28 37
18	0 13 41.98 310.83	1 24 46.1 1947.5	3.25	8.55	.028 892 14 465	10 29 48
19	0 18 52.81 316.96	0 52 18.6 2018.7	3.20	8.43	.043 357 14 393	10 31 05
20	0 24 09.77 323.06	- 0 18 39.9 2087.6	3.16	8.32	.057 750 14 313	10 32 28
21	0 29 32.83 +329.15	+ 0 16 07.7 ^s +2154.5	3.12	8.21	1.072 063 +14 219	10 33 57
22	0 35 01.98 335.24	0 52 02.2 2218.9	3.07	8.10	.086 282 14 114	10 35 32
23	0 40 37.22 341.40	1 29 01.1 2281.3	3.04	8.00	.100 396 13 993	10 37 14
24	0 46 18.62 347.63	2 07 02.4 2341.3	3.00	7.90	.114 389 13 857	10 39 02
25	0 52 06.25 353.97	2 46 03.7 2399.0	2.96	7.80	.128 246 13 701	10 40 56
26	0 58 00.22 +360.42	+ 3 26 02.7 ^s +2454.2	2.92	7.71	1.141 947 +13 524	10 42 56
27	1 04 00.64 367.05	4 06 56.9 2506.8	2.89	7.62	.155 471 13 325	10 45 03
28	1 10 07.69 373.85	4 48 43.7 2556.9	2.86	7.53	.168 796 13 097	10 47 17
29	1 16 21.54 380.84	5 31 20.6 2603.9	2.83	7.45	.181 893 12 840	10 49 38
30	1 22 42.38 388.05	6 14 44.5 2647.8	2.80	7.37	.194 733 12 548	10 52 05
May 1	1 29 10.43 +395.49	+ 6 58 52.3 ^s +2688.4	2.77	7.29	1.207 281 +12 219	10 54 40
2	1 35 45.92 403.18	7 43 40.7 2725.1	2.74	7.22	.219 500 11 845	10 57 23
3	1 42 29.10 411.12	8 29 05.8 2757.9	2.71	7.15	.231 345 11 426	11 00 14
4	1 49 20.22 419.31	9 15 03.7 2786.2	2.69	7.08	.242 771 10 953	11 03 12
5	1 56 19.53 427.75	10 01 29.9 2809.3	2.66	7.02	.253 724 10 423	11 06 19
6	2 03 27.28 +436.43	+10 48 19.2 ^s +2826.8	2.64	6.96	1.264 147 + 9 829	11 09 35
7	2 10 43.71 445.31	11 35 26.0 2838.2	2.62	6.91	.273 976 9 169	11 13 00
8	2 18 09.02 454.38	12 22 44.2 2842.7	2.60	6.86	.283 145 8 435	11 16 33
9	2 25 43.40 463.57	13 10 06.9 2839.6	2.59	6.81	.291 580 7 625	11 20 16
10	2 33 26.97 472.84	13 57 26.5 2828.0	2.57	6.77	.299 205 6 734	11 24 08
11	2 41 19.81 +482.08	+14 44 34.5 ^s +2807.2	2.56	6.74	1.305 939 + 5 762	11 28 09
12	2 49 21.89 491.23	15 31 21.7 2776.5	2.55	6.71	.311 701 4 706	11 32 20
13	2 57 33.12 500.16	16 17 38.2 2734.9	2.54	6.68	.316 407 3 571	11 36 40
14	3 05 53.28 508.73	17 03 13.1 2682.1	2.53	6.67	.319 978 2 358	11 41 08
15	3 14 22.01 516.82	17 47 55.2 2617.1	2.53	6.65	.322 336 + 1 074	11 45 45
16	3 22 58.83 +524.27	+18 31 32.3 ^s +2540.0	2.52	6.65	1.323 410 - 269	11 50 30
17	3 31 43.10	+19 13 52.3	2.52	6.65	1.323 141	11 55 22

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	3 31 43.10	+19 13 52.3	2.52	6.65	1.323 141	11 55 22
18	3 40 34.04	19 54 42.7	2.53	6.66	321 481 - 1 660	12 00 21
19	3 49 30.71	20 33 51.2	2.53	6.67	318 397 3 084	12 05 24
20	3 58 32.06	21 11 06.1	2.54	6.70	313 872 4 525	12 10 32
21	4 07 36.88	21 46 16.3	2.55	6.73	307 909 5 963	12 15 43
						7 379
22	4 16 43.90	+22 19 11.9	2.57	6.77	1.300 530	12 20 55
23	4 25 51.77	22 49 44.3	2.59	6.81	291 776 - 8 754	12 26 07
24	4 34 59.12	23 17 46.3	2.61	6.87	281 703 10 073	12 31 19
25	4 44 04.54	23 43 12.4	2.63	6.93	270 384 11 319	12 36 27
26	4 53 06.69	24 05 59.0	2.66	7.00	257 904 12 480	12 41 31
						13 546
27	5 02 04.27	+24 26 03.8	2.68	7.07	1.244 358	12 46 30
28	5 10 56.04	24 43 26.4	2.72	7.16	229 846 -14 512	12 51 23
29	5 19 40.88	24 58 08.0	2.75	7.25	214 471 15 375	12 56 08
30	5 28 17.74	25 10 10.8	2.79	7.34	198 339 16 132	13 00 45
31	5 36 45.70	25 19 38.3	2.83	7.45	181 551 16 788	13 05 12
						17 346
June 1	5 45 03.92	+25 26 35.1	2.87	7.56	1.164 205	13 09 28
2	5 53 11.68	25 31 06.4	2.91	7.68	146 395 -17 810	13 13 34
3	6 01 08.34	25 33 18.1	2.96	7.80	128 208 18 187	13 17 29
4	6 08 53.36	25 33 16.4	3.01	7.93	109 725 18 483	13 21 11
5	6 16 26.26	25 31 08.1	3.06	8.07	091 019 18 706	13 24 41
						18 862
6	6 23 46.63	+25 27 00.0	3.12	8.21	1.072 157	13 27 58
7	6 30 54.11	25 20 59.1	3.17	8.36	053 200 -18 957	13 31 02
8	6 37 48.41	25 13 12.6	3.23	8.51	034 203 18 997	13 33 53
9	6 44 29.25	25 03 47.3	3.29	8.67	1.015 214 18 989	13 36 29
10	6 50 56.39	24 52 50.4	3.35	8.83	0.996 276 18 938	13 38 52
						18 847
11	6 57 09.62	+24 40 28.9	3.42	9.00	0.977 429	13 41 01
12	7 03 08.72	24 26 49.6	3.48	9.18	958 706 -18 723	13 42 56
13	7 08 53.49	24 11 59.2	3.55	9.36	940 138 18 568	13 44 36
14	7 14 23.76	23 56 04.4	3.62	9.55	921 754 18 384	13 46 01
15	7 19 39.32	23 39 11.8	3.70	9.74	903 579 18 175	13 47 12
						17 945
16	7 24 39.96	+23 21 27.9	3.77	9.94	0.885 634	13 48 07
17	7 29 25.49	23 02 59.1	3.85	10.14	867 942 -17 692	13 48 47
18	7 33 55.68	22 43 51.7	3.93	10.35	850 523 17 419	13 49 12
19	7 38 10.28	22 24 12.1	4.01	10.56	833 395 17 128	13 49 21
20	7 42 09.05	22 04 06.4	4.09	10.78	816 579 16 816	13 49 14
						16 487
21	7 45 51.71	+21 43 41.0	4.17	11.00	0.800 092	13 48 51
22	7 49 17.98	21 23 01.9	4.26	11.23	783 953 -16 139	13 48 11
23	7 52 27.55	21 02 15.5	4.35	11.46	768 182 15 771	13 47 14
24	7 55 20.11	20 41 28.0	4.44	11.69	752 799 15 383	13 46 00
25	7 57 55.34	20 20 45.6	4.53	11.93	737 825 14 974	13 44 29
						14 542
26	8 00 12.90	+20 00 14.5	4.62	12.17	0.723 283	13 42 40
27	8 02 12.48	19 40 01.2	4.71	12.41	709 197 -14 086	13 40 33
28	8 03 53.77	19 20 11.9	4.80	12.65	695 594 13 603	13 38 07
29	8 05 16.47	19 00 52.9	4.89	12.89	682 501 13 093	13 35 23
30	8 06 20.34	18 42 10.6	4.99	13.14	669 949 12 552	13 32 20
						11 979
July 1	8 07 05.18	+18 24 11.4	5.08	13.37	0.657 970	13 28 58
2	8 07 30.85	+18 07 01.4	5.17	13.61	0.646 600 -11 370	13 25 17

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	8 07 05.18 + 25.67	+18 24 11.4 - 1030.0	5.08	13.37	0.657 970 - 11 370	13 28 58
2	8 07 30.85 + 6.45	18 07 01.4 974.7	5.17	13.61	.646 600 10 724	13 25 17
3	8 07 37.30 - 12.69	17 50 46.7 913.1	5.25	13.84	.635 876 10 038	13 21 17
4	8 07 24.61 31.62	17 35 33.6 846.0	5.34	14.06	.625 838 9 310	13 16 58
5	8 06 52.99 50.21	17 21 27.6 773.2	5.42	14.27	.616 528 8 536	13 12 20
6	8 06 02.78 - 68.23	+17 08 34.4 - 695.4	5.49	14.47	0.607 992 - 7 718	13 07 24
7	8 04 54.55 85.50	16 56 59.0 612.9	5.56	14.66	.600 274 6 851	13 02 11
8	8 03 29.05 101.77	16 46 46.1 526.4	5.63	14.83	.593 423 5 935	12 56 41
9	8 01 47.28 116.81	16 37 59.7 436.4	5.69	14.98	.587 488 4 972	12 50 56
10	7 59 50.47 130.35	16 30 43.3 344.0	5.73	15.11	.582 516 3 960	12 44 57
11	7 57 40.12 - 142.13	+16 24 59.3 - 249.6	5.77	15.21	0.578 556 - 2 900	12 38 45
12	7 55 17.99 151.90	16 20 49.7 154.6	5.80	15.29	.575 656 1 796	12 32 23
13	7 52 46.09 159.42	16 18 15.1 - 59.7	5.82	15.33	.573 860 - 651	12 25 52
14	7 50 06.67 164.50	16 17 15.4 + 34.1	5.83	15.35	.573 209 + 535	12 19 15
15	7 47 22.17 166.93	16 17 49.5 125.7	5.82	15.34	.573 744 1 754	12 12 34
16	7 44 35.24 - 166.65	+16 19 55.2 + 214.1	5.80	15.29	0.575 498 + 3 001	12 05 52
17	7 41 48.59 163.54	16 23 29.3 298.4	5.77	15.21	.578 499 4 273	11 59 12
18	7 39 05.05 157.61	16 28 27.7 377.8	5.73	15.10	.582 772 5 563	11 52 36
19	7 36 27.44 148.91	16 34 45.5 451.2	5.68	14.96	.588 335 6 862	11 46 08
20	7 33 58.53 137.51	16 42 16.7 518.3	5.61	14.79	.595 197 8 168	11 39 49
21	7 31 41.02 - 123.59	+16 50 55.0 + 578.1	5.54	14.58	0.603 365 + 9 472	11 33 43
22	7 29 37.43 107.33	17 00 33.1 630.3	5.45	14.36	.612 837 10 768	11 27 52
23	7 27 50.10 88.93	17 11 03.4 674.5	5.36	14.11	.623 605 12 051	11 22 18
24	7 26 21.17 68.64	17 22 17.9 710.1	5.25	13.84	.635 656 13 314	11 17 03
25	7 25 12.53 46.72	17 34 08.0 736.8	5.15	13.56	.648 970 14 553	11 12 09
26	7 24 25.81 - 23.40	+17 46 24.8 + 754.6	5.03	13.26	0.663 523 + 15 760	11 07 37
27	7 24 02.41 + 1.07	17 58 59.4 763.0	4.92	12.95	.679 283 16 935	11 03 29
28	7 24 03.48 + 26.44	18 11 42.4 761.8	4.80	12.64	.696 218 18 066	10 59 46
29	7 24 29.92 52.53	18 24 24.2 750.8	4.68	12.32	.714 284 19 155	10 56 28
30	7 25 22.45 79.09	18 36 55.0 729.7	4.55	12.00	.733 439 20 191	10 53 36
31	7 26 41.54 + 105.97	+18 49 04.7 + 698.5	4.43	11.68	0.753 630 + 21 171	10 51 11
Aug. 1	7 28 27.51 132.99	19 00 43.2 656.7	4.31	11.36	.774 801 22 088	10 49 13
2	7 30 40.50 159.98	19 11 39.9 604.4	4.19	11.04	.796 889 22 937	10 47 42
3	7 33 20.48 186.80	19 21 44.3 541.1	4.07	10.73	.819 826 23 706	10 46 37
4	7 36 27.28 213.29	19 30 45.4 466.9	3.96	10.43	.843 532 24 391	10 46 00
5	7 40 00.57 + 239.32	+19 38 32.3 + 381.7	3.85	10.14	0.867 923 + 24 982	10 45 48
6	7 43 59.89 264.73	19 44 54.0 285.3	3.74	9.86	.892 905 25 469	10 46 02
7	7 48 24.62 289.38	19 49 39.3 178.2	3.64	9.58	.918 374 25 842	10 46 42
8	7 53 14.00 313.10	19 52 37.5 + 60.6	3.54	9.32	.944 216 26 094	10 47 45
9	7 58 27.10 335.73	19 53 38.1 - 67.3	3.44	9.07	.970 310 26 212	10 49 12
10	8 04 02.83 + 357.11	+19 52 30.8 - 204.2	3.35	8.83	0.996 522 + 26 192	10 51 01
11	8 09 59.94 377.07	19 49 06.6 349.6	3.27	8.60	1.022 714 26 026	10 53 11
12	8 16 17.01 395.44	19 43 17.0 502.0	3.18	8.39	.048 740 25 712	10 55 41
13	8 22 52.45 412.09	19 34 55.0 659.9	3.11	8.19	.074 452 25 246	10 58 28
14	8 29 44.54 426.86	19 23 55.1 821.8	3.04	8.00	.099 698 24 633	11 01 31
15	8 36 51.40 + 439.69	+19 10 13.3 - 985.6	2.97	7.83	1.124 331 + 23 880	11 04 48
16	8 44 11.09	+18 53 47.7	2.91	7.66	1.148 211	11 08 16

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
Aug. 16	^{h m s} 8 44 11.09	^{° ' "} +18 53 47.7	["] 2.91	["] 7.66	1.148 211	^{h m s} 11 08 16
17	8 51 41.58	18 34 38.3	2.85	7.51	1.171 207	11 11 55
18	8 59 20.83	18 12 47.0	2.80	7.38	1.193 202	11 15 42
19	9 07 06.84	17 48 17.6	2.75	7.25	1.214 093	11 19 34
20	9 14 57.64	17 21 15.8	2.71	7.13	1.233 798	11 23 31
21	9 22 51.42	+16 51 48.8	2.67	7.03	1.252 254	11 27 30
22	9 30 46.45	16 20 04.9	2.63	6.93	1.269 418	11 31 29
23	9 38 41.21	15 46 13.6	2.60	6.85	1.285 263	11 35 27
24	9 46 34.34	15 10 24.9	2.57	6.77	1.299 784	11 39 23
25	9 54 24.69	14 32 49.3	2.54	6.70	1.312 988	11 43 16
26	10 02 11.27	+13 53 37.3	2.52	6.64	1.324 898	11 47 04
27	10 09 53.29	13 12 59.4	2.50	6.59	1.335 545	11 50 48
28	10 17 30.11	12 31 05.5	2.48	6.54	1.344 972	11 54 26
29	10 25 01.27	11 48 05.5	2.47	6.50	1.353 223	11 57 58
30	10 32 26.42	11 04 08.4	2.46	6.47	1.360 352	12 01 24
31	10 39 45.33	+10 19 23.0	2.44	6.44	1.366 410	12 04 44
Sept. 1	10 46 57.88	9 33 57.0	2.44	6.42	1.371 451	12 07 57
2	10 54 04.03	8 47 57.9	2.43	6.40	1.375 528	12 11 04
3	11 01 03.80	8 01 32.3	2.42	6.38	1.378 694	12 14 04
4	11 07 57.29	7 14 46.5	2.42	6.37	1.381 000	12 16 58
5	11 14 44.61	+ 6 27 46.0	2.42	6.37	1.382 491	12 19 46
6	11 21 25.94	5 40 35.8	2.41	6.36	1.383 213	12 22 28
7	11 28 01.45	4 53 20.6	2.41	6.36	1.383 207	12 25 05
8	11 34 31.37	4 06 04.4	2.42	6.37	1.382 513	12 27 35
9	11 40 55.89	3 18 51.1	2.42	6.37	1.381 163	12 30 01
10	11 47 15.26	+ 2 31 44.2	2.42	6.38	1.379 192	12 32 21
11	11 53 29.69	1 44 46.7	2.43	6.39	1.376 629	12 34 37
12	11 59 39.42	0 58 01.5	2.43	6.41	1.373 499	12 36 48
13	12 05 44.65	+ 0 11 31.3	2.44	6.42	1.369 828	12 38 55
14	12 11 45.62	- 0 34 41.6	2.45	6.44	1.365 636	12 40 57
15	12 17 42.52	- 1 20 35.0	2.45	6.47	1.360 942	12 42 55
16	12 23 35.56	2 06 06.8	2.46	6.49	1.355 764	12 44 50
17	12 29 24.92	2 51 15.0	2.47	6.52	1.350 116	12 46 41
18	12 35 10.79	3 35 57.8	2.49	6.55	1.344 011	12 48 29
19	12 40 53.33	4 20 13.6	2.50	6.58	1.337 460	12 50 13
20	12 46 32.70	- 5 04 00.8	2.51	6.61	1.330 474	12 51 55
21	12 52 09.05	5 47 17.6	2.52	6.65	1.323 059	12 53 33
22	12 57 42.50	6 30 02.8	2.54	6.69	1.315 225	12 55 08
23	13 03 13.15	7 12 14.7	2.56	6.73	1.306 975	12 56 41
24	13 08 41.12	7 53 52.0	2.57	6.78	1.298 314	12 58 11
25	13 14 06.48	- 8 34 53.1	2.59	6.83	1.289 246	12 59 39
26	13 19 29.30	9 15 16.8	2.61	6.88	1.279 775	13 01 04
27	13 24 49.60	9 55 01.4	2.63	6.93	1.269 900	13 02 26
28	13 30 07.43	10 34 05.7	2.65	6.99	1.259 625	13 03 46
29	13 35 22.78	11 12 28.0	2.67	7.05	1.248 949	13 05 04
30	13 40 35.63	-11 50 06.9	2.70	7.11	1.237 874	13 06 19
Oct. 1	13 45 45.94	-12 27 00.7	2.72	7.18	1.226 397	13 07 31

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct. 1	13 45 45.94 +307.69	-12 27 00.7 -2167.1	2.72	7.18	1.226 397 -11 878	13 07 31
2	13 50 53.63 304.97	13 03 07.8 2118.7	2.75	7.25	.214 519 12 280	13 08 41
3	13 55 58.60 302.14	13 38 26.5 2068.6	2.78	7.32	.202 239 12 684	13 09 48
4	14 01 00.74 299.12	14 12 55.1 2016.4	2.81	7.40	.189 555 13 088	13 10 52
5	14 05 59.86 295.90	14 46 31.5 1962.5	2.84	7.48	.176 467 13 496	13 11 53
6	14 10 55.76 +292.44	-15 19 14.0 -1906.2	2.87	7.57	1.162 971 -13 902	13 12 50
7	14 15 48.20 288.68	15 51 00.2 1847.7	2.91	7.66	.149 069 14 310	13 13 44
8	14 20 36.88 284.55	16 21 47.9 1786.9	2.94	7.75	.134 759 14 719	13 14 34
9	14 25 21.43 280.03	16 51 34.8 1723.3	2.98	7.86	.120 040 15 125	13 15 19
10	14 30 01.46 275.02	17 20 18.1 1657.0	3.02	7.96	.104 915 15 532	13 16 00
11	14 34 36.48 +269.45	-17 47 55.1 -1587.4	3.07	8.08	1.089 383 -15 934	13 16 36
12	14 39 05.93 263.24	18 14 22.5 1514.7	3.11	8.20	.073 449 16 331	13 17 05
13	14 43 29.17 256.31	18 39 37.2 1438.0	3.16	8.32	.057 118 16 722	13 17 28
14	14 47 45.48 248.54	19 03 35.2 1357.6	3.21	8.46	.040 396 17 101	13 17 44
15	14 51 54.02 239.83	19 26 12.8 1272.5	3.26	8.60	.023 295 17 468	13 17 51
16	14 55 53.85 +230.05	-19 47 25.3 -1182.5	3.32	8.75	1.005 827 -17 818	13 17 49
17	14 59 43.90 219.07	20 07 07.8 1087.2	3.38	8.91	0.988 009 18 144	13 17 37
18	15 03 22.97 206.74	20 25 15.0 985.8	3.44	9.07	.969 865 18 442	13 17 13
19	15 06 49.71 192.90	20 41 40.8 877.6	3.51	9.25	.951 423 18 706	13 16 35
20	15 10 02.61 177.40	20 56 18.4 761.9	3.58	9.43	.932 717 18 927	13 15 43
21	15 13 00.01 +160.04	-21 09 00.3 -637.9	3.66	9.63	0.913 790 -19 093	13 14 35
22	15 15 40.05 140.69	21 19 38.2 594.5	3.73	9.84	.894 697 19 194	13 13 08
23	15 18 00.74 119.16	21 28 02.7 360.8	3.81	10.05	.875 503 19 219	13 11 21
24	15 19 59.90 95.32	21 34 03.5 205.4	3.90	10.28	.856 284 19 149	13 09 11
25	15 21 35.22 69.07	21 37 28.9 37.5	3.99	10.51	.837 135 18 968	13 06 36
26	15 22 44.29 +40.38	-21 38 06.4 +143.9	4.08	10.76	0.818 167 -18 656	13 03 33
27	15 23 24.67 +9.30	21 35 42.5 339.9	4.18	11.01	.799 511 18 191	13 00 01
28	15 23 33.97 -23.98	21 30 02.6 550.4	4.27	11.26	.781 320 17 549	12 55 56
29	15 23 09.99 59.12	21 20 52.2 775.4	4.37	11.52	.763 771 16 706	12 51 18
30	15 22 10.87 95.55	21 07 56.8 1013.3	4.47	11.78	.747 065 15 637	12 46 04
31	15 20 35.32 -132.49	-20 51 03.5 +1261.0	4.57	12.03	0.731 428 -14 320	12 40 14
Nov. 1	15 18 22.83 168.83	20 30 02.5 1513.6	4.66	12.27	.717 108 12 736	12 33 48
2	15 15 34.00 203.26	20 04 48.9 1763.8	4.74	12.49	.704 372 10 873	12 26 46
3	15 12 10.74 234.23	19 35 25.1 2001.6	4.82	12.69	.693 499 8 728	12 19 12
4	15 08 16.51 260.09	19 02 03.5 2215.0	4.88	12.85	.684 771 6 314	12 11 10
5	15 03 56.42 -279.19	-18 25 08.5 +2390.3	4.92	12.97	0.678 457 -3 657	12 02 46
6	14 59 17.23 290.16	17 45 18.2 2513.8	4.95	13.04	.674 800 -801	11 54 07
7	14 54 27.07 292.02	17 03 24.4 2573.6	4.96	13.06	.673 999 +2 196	11 45 21
8	14 49 35.05 284.37	16 20 30.8 2561.6	4.94	13.01	.676 195 5 260	11 36 39
9	14 44 50.68 267.45	15 37 49.2 2474.4	4.90	12.91	.681 455 8 309	11 28 08
10	14 40 23.23 -242.17	-14 56 34.8 +2315.2	4.84	12.76	0.689 764 +11 263	11 19 57
11	14 36 21.06 209.87	14 17 59.6 2092.4	4.76	12.55	.701 027 14 045	11 12 16
12	14 32 51.19 172.27	13 43 07.2 1818.6	4.67	12.31	.715 072 16 591	11 05 08
13	14 29 58.92 131.19	13 12 48.6 1508.8	4.56	12.03	.731 663 18 852	10 58 40
14	14 27 47.73 88.35	12 47 39.8 1178.6	4.45	11.73	.750 515 20 795	10 52 53
15	14 26 19.38 -45.31	-12 28 01.2 +842.0	4.33	11.41	0.771 310 +22 404	10 47 48
16	14 25 34.07	-12 13 59.2	4.21	11.09	0.793 714	10 43 26

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	14 25 34.07 - 3 ^s .29	-12 13 59.2 + 511 ["] .6	4.21	11.09	0.793 714 +23 681	10 43 26
17	14 25 30.78 + 36 ^m .76	12 05 27.6 + 196 ^m .6	4.09	10.77	.817 395 24 640	10 39 45
18	14 26 07.54 74 ^m .23	12 02 11.0 - 96 ^m .4	3.97	10.45	.842 035 25 300	10 36 43
19	14 27 21.77 108 ^m .74	12 03 47.4 363 ^m .1	3.85	10.15	.867 335 25 691	10 34 16
20	14 29 10.51 140 ^m .15	12 09 50.5 601 ^m .4	3.74	9.85	.893 026 25 844	10 32 23
21	14 31 30.66 +168 ^m .43	-12 19 51.9 - 810 ^m .7	3.63	9.58	0.918 870 +25 792	10 30 59
22	14 34 19.09 193 ^m .73	12 33 22.6 991 ^m .8	3.54	9.32	.944 662 25 566	10 30 02
23	14 37 32.82 216 ^m .23	12 49 54.4 1146 ^m .1	3.44	9.07	.970 228 25 196	10 29 30
24	14 41 09.05 236 ^m .16	13 09 00.5 1275 ^m .3	3.36	8.84	0.995 424 24 708	10 29 18
25	14 45 05.21 253 ^m .77	13 30 15.8 1381 ^m .7	3.27	8.63	1.020 132 24 128	10 29 26
26	14 49 18.98 +269 ^m .32	-13 53 17.5 -1467 ^m .6	3.20	8.43	1.044 260 +23 475	10 29 50
27	14 53 48.30 283 ^m .04	14 17 45.1 1534 ^m .8	3.13	8.24	.067 735 22 769	10 30 29
28	14 58 31.34 295 ^m .16	14 43 19.9 1585 ^m .7	3.06	8.07	.090 504 22 022	10 31 21
29	15 03 26.50 305 ^m .91	15 09 45.6 1622 ^m .1	3.00	7.91	.112 526 21 249	10 32 25
30	15 08 32.41 315 ^m .42	15 36 47.7 1645 ^m .5	2.95	7.76	.133 775 20 459	10 33 39
Dec. 1	15 13 47.83 +323 ^m .92	-16 04 13.2 -1657 ^m .9	2.89	7.62	1.154 234 +19 660	10 35 01
2	15 19 11.75 331 ^m .51	16 31 51.1 1660 ^m .0	2.85	7.50	.173 894 18 860	10 36 32
3	15 24 43.26 338 ^m .33	16 59 31.1 1653 ^m .6	2.80	7.38	.192 754 18 062	10 38 10
4	15 30 21.59 344 ^m .49	17 27 04.7 1639 ^m .4	2.76	7.27	.210 816 17 272	10 39 55
5	15 36 06.08 350 ^m .08	17 54 24.1 1618 ^m .5	2.72	7.17	.228 088 16 491	10 41 46
6	15 41 56.16 +355 ^m .20	-18 21 22.6 -1591 ^m .6	2.68	7.07	1.244 579 +15 722	10 43 42
7	15 47 51.36 359 ^m .89	18 47 54.2 1559 ^m .3	2.65	6.98	.260 301 14 967	10 45 43
8	15 53 51.25 364 ^m .24	19 13 53.5 1522 ^m .4	2.62	6.90	.275 268 14 226	10 47 48
9	15 59 55.49 368 ^m .26	19 39 15.9 1481 ^m .1	2.59	6.82	.289 494 13 500	10 49 58
10	16 06 03.75 372 ^m .03	20 03 57.0 1436 ^m .2	2.56	6.75	.302 994 12 789	10 52 12
11	16 12 15.78 +375 ^m .57	-20 27 53.2 -1387 ^m .8	2.54	6.69	1.315 783 +12 093	10 54 29
12	16 18 31.35 378 ^m .92	20 51 01.0 1336 ^m .3	2.52	6.63	.327 876 11 412	10 56 50
13	16 24 50.27 382 ^m .09	21 13 17.3 1282 ^m .0	2.49	6.57	.339 288 10 745	10 59 14
14	16 31 12.36 385 ^m .10	21 34 39.3 1225 ^m .1	2.47	6.52	.350 033 10 091	11 01 41
15	16 37 37.46 387 ^m .99	21 55 04.4 1165 ^m .9	2.46	6.47	.360 124 9 451	11 04 11
16	16 44 05.45 +390 ^m .75	-22 14 30.3 -1104 ^m .4	2.44	6.43	1.369 575 + 8 822	11 06 44
17	16 50 36.20 393 ^m .39	22 32 54.7 1041 ^m .0	2.42	6.38	.378 397 8 206	11 09 20
18	16 57 09.59 395 ^m .92	22 50 15.7 975 ^m .5	2.41	6.35	.386 603 7 598	11 11 58
19	17 03 45.51 398 ^m .36	23 06 31.2 908 ^m .4	2.40	6.31	.394 201 7 002	11 14 39
20	17 10 23.87 400 ^m .70	23 21 39.6 839 ^m .4	2.38	6.28	.401 203 6 414	11 17 22
21	17 17 04.57 +402 ^m .95	-23 35 39.0 - 768 ^m .8	2.37	6.25	1.407 617 + 5 834	11 20 08
22	17 23 47.52 405 ^m .11	23 48 27.8 696 ^m .7	2.36	6.23	.413 451 5 262	11 22 56
23	17 30 32.63 407 ^m .18	24 00 04.5 623 ^m .1	2.35	6.20	.418 713 4 695	11 25 45
24	17 37 19.81 409 ^m .18	24 10 27.6 548 ^m .0	2.35	6.18	.423 408 4 133	11 28 37
25	17 44 08.99 411 ^m .10	24 19 35.6 471 ^m .5	2.34	6.16	.427 541 3 576	11 31 31
26	17 51 00.09 +412 ^m .92	-24 27 27.1 - 393 ^m .8	2.33	6.15	1.431 117 + 3 022	11 34 27
27	17 57 53.01 414 ^m .66	24 34 00.9 314 ^m .6	2.33	6.14	.434 139 2 470	11 37 25
28	18 04 47.67 416 ^m .31	24 39 15.5 234 ^m .4	2.32	6.13	.436 609 1 917	11 40 24
29	18 11 43.98 417 ^m .88	24 43 09.9 152 ^m .9	2.32	6.12	.438 526 1 366	11 43 25
30	18 18 41.86 419 ^m .34	24 45 42.8 - 70 ^m .2	2.32	6.11	.439 892 813	11 46 27
31	18 25 41.20 +420 ^m .71	-24 46 53.0 + 13 ^m .6	2.32	6.11	1.440 705 + 256	11 49 31
32	18 32 41.91	-24 46 39.4	2.32	6.11	1.440 961	11 52 36

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	15 41 48.63 ^s	-17 16 05.2	8.05	8.42	1.044 887	9 07 27
1	15 46 39.26 ^s	17 33 17.5	8.00	8.37	.051 716	9 08 22
2	15 51 31.14	17 50 05.9	7.95	8.31	.058 521	9 09 18
3	15 56 24.25	18 06 29.9	7.89	8.26	.065 302	9 10 15
4	16 01 18.60	18 22 28.6	7.84	8.21	.072 059	9 11 13
5	16 06 14.16	-18 38 01.2	7.80	8.16	1.078 792	9 12 12
6	16 11 10.92	18 53 07.1	7.75	8.11	.085 502	9 13 13
7	16 16 08.88	19 07 45.6	7.70	8.06	.092 188	9 14 15
8	16 21 08.01	19 21 55.8	7.65	8.01	.098 850	9 15 18
9	16 26 08.29	19 35 37.2	7.61	7.96	.105 488	9 16 22
10	16 31 09.71	-19 48 49.0	7.56	7.91	1.112 102	9 17 28
11	16 36 12.24	20 01 30.6	7.52	7.87	.118 692	9 18 34
12	16 41 15.86	20 13 41.5	7.47	7.82	.125 257	9 19 42
13	16 46 20.54	20 25 20.8	7.43	7.78	.131 798	9 20 50
14	16 51 26.25	20 36 28.0	7.39	7.73	.138 314	9 22 00
15	16 56 32.96	-20 47 02.5	7.35	7.69	1.144 804	9 23 11
16	17 01 40.63	20 57 03.8	7.30	7.64	.151 269	9 24 22
17	17 06 49.24	21 06 31.3	7.26	7.60	.157 709	9 25 35
18	17 11 58.74	21 15 24.4	7.22	7.56	.164 121	9 26 48
19	17 17 09.09	21 23 42.6	7.18	7.52	.170 508	9 28 02
20	17 22 20.25	-21 31 25.5	7.15	7.48	1.176 867	9 29 17
21	17 27 32.19	21 38 32.6	7.11	7.44	.183 200	9 30 33
22	17 32 44.85	21 45 03.4	7.07	7.40	.189 504	9 31 49
23	17 37 58.19	21 50 57.5	7.03	7.36	.195 780	9 33 06
24	17 43 12.15	21 56 14.7	7.00	7.32	.202 027	9 34 24
25	17 48 26.68	-22 00 54.4	6.96	7.28	1.208 245	9 35 42
26	17 53 41.73	22 04 56.5	6.93	7.25	.214 434	9 37 01
27	17 58 57.23	22 08 20.6	6.89	7.21	.220 594	9 38 20
28	18 04 13.14	22 11 06.5	6.86	7.17	.226 725	9 39 40
29	18 09 29.39	22 13 13.8	6.82	7.14	.232 826	9 41 00
30	18 14 45.91	-22 14 42.4	6.79	7.10	1.238 898	9 42 20
31	18 20 02.67	22 15 32.2	6.76	7.07	.244 941	9 43 40
Feb. 1	18 25 19.59	22 15 42.9	6.72	7.03	.250 955	9 45 01
2	18 30 36.64	22 15 14.5	6.69	7.00	.256 941	9 46 21
3	18 35 53.74	22 14 06.8	6.66	6.97	.262 899	9 47 42
4	18 41 10.86	-22 12 19.9	6.63	6.94	1.268 828	9 49 03
5	18 46 27.94	22 09 53.7	6.60	6.90	.274 729	9 50 23
6	18 51 44.92	22 06 48.2	6.57	6.87	.280 602	9 51 44
7	18 57 01.75	22 03 03.6	6.54	6.84	.286 447	9 53 04
8	19 02 18.39	21 58 39.7	6.51	6.81	.292 264	9 54 24
9	19 07 34.77	-21 53 36.9	6.48	6.78	1.298 053	9 55 44
10	19 12 50.85	21 47 55.1	6.45	6.75	.303 813	9 57 03
11	19 18 06.58	21 41 34.6	6.42	6.72	.309 546	9 58 22
12	19 23 21.91	21 34 35.5	6.39	6.69	.315 251	9 59 41
13	19 28 36.79	21 26 58.0	6.37	6.66	.320 927	10 00 59
14	19 33 51.19	-21 18 42.4	6.34	6.63	1.326 574	10 02 17
15	19 39 05.06	21 09 49.0	6.31	6.61	1.332 192	10 03 34

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	19 39 05.06	-21 09 49.0	6.31	6.61	1.332 192	10 03 34
16	19 44 18.35	21 00 18.1	6.29	6.58	1.337 782	10 04 51
17	19 49 31.03	20 50 09.8	6.26	6.55	1.343 342	10 06 06
18	19 54 43.06	20 39 24.8	6.23	6.52	1.348 871	10 07 22
19	19 59 54.40	20 28 03.1	6.21	6.50	1.354 371	10 08 36
20	20 05 05.02	-20 16 05.4	6.18	6.47	1.359 840	10 09 50
21	20 10 14.87	20 03 32.0	6.16	6.45	1.365 277	10 11 03
22	20 15 23.93	19 50 23.4	6.14	6.42	1.370 683	10 12 15
23	20 20 32.16	19 36 40.1	6.11	6.40	1.376 057	10 13 27
24	20 25 39.53	19 22 22.5	6.09	6.37	1.381 400	10 14 37
25	20 30 46.00	-19 07 31.1	6.06	6.35	1.386 709	10 15 47
26	20 35 51.55	18 52 06.6	6.04	6.32	1.391 987	10 16 55
27	20 40 56.16	18 36 09.4	6.02	6.30	1.397 232	10 18 03
28	20 45 59.80	18 19 40.0	6.00	6.27	1.402 445	10 19 10
29	20 51 02.46	18 02 39.1	5.97	6.25	1.407 625	10 20 16
Mar. 1	20 56 04.12	-17 45 07.3	5.95	6.23	1.412 773	10 21 20
2	21 01 04.77	17 27 05.0	5.93	6.21	1.417 889	10 22 24
3	21 06 04.40	17 08 33.0	5.91	6.18	1.422 973	10 23 27
4	21 11 03.01	16 49 31.8	5.89	6.16	1.428 025	10 24 28
5	21 16 00.58	16 30 02.1	5.87	6.14	1.433 046	10 25 29
6	21 20 57.12	-16 10 04.5	5.85	6.12	1.438 035	10 26 28
7	21 25 52.63	15 49 39.7	5.83	6.10	1.442 992	10 27 27
8	21 30 47.10	15 28 48.3	5.81	6.08	1.447 918	10 28 25
9	21 35 40.55	15 07 31.0	5.79	6.06	1.452 812	10 29 21
10	21 40 32.97	14 45 48.4	5.77	6.04	1.457 674	10 30 17
11	21 45 24.38	-14 23 41.3	5.75	6.02	1.462 505	10 31 11
12	21 50 14.78	14 01 10.2	5.73	6.00	1.467 304	10 32 04
13	21 55 04.19	13 38 15.8	5.71	5.98	1.472 070	10 32 57
14	21 59 52.63	13 14 58.9	5.69	5.96	1.476 805	10 33 48
15	22 04 40.12	12 51 20.1	5.68	5.94	1.481 507	10 34 39
16	22 09 26.67	-12 27 20.0	5.66	5.92	1.486 176	10 35 28
17	22 14 12.30	12 02 59.4	5.64	5.90	1.490 812	10 36 17
18	22 18 57.03	11 38 19.0	5.62	5.88	1.495 415	10 37 05
19	22 23 40.89	11 13 19.4	5.61	5.87	1.499 983	10 37 52
20	22 28 23.89	10 48 01.4	5.59	5.85	1.504 516	10 38 38
21	22 33 06.06	-10 22 25.6	5.57	5.83	1.509 013	10 39 23
22	22 37 47.42	9 56 32.9	5.56	5.81	1.513 475	10 40 08
23	22 42 27.99	9 30 23.9	5.54	5.80	1.517 901	10 40 52
24	22 47 07.79	9 03 59.4	5.52	5.78	1.522 290	10 41 34
25	22 51 46.85	8 37 20.0	5.51	5.76	1.526 641	10 42 17
26	22 56 25.20	-8 10 26.5	5.49	5.75	1.530 956	10 42 58
27	23 01 02.86	7 43 19.5	5.48	5.73	1.535 233	10 43 39
28	23 05 39.87	7 15 59.9	5.46	5.72	1.539 472	10 44 19
29	23 10 16.25	6 48 28.2	5.45	5.70	1.543 674	10 44 59
30	23 14 52.03	6 20 45.3	5.43	5.69	1.547 838	10 45 38
31	23 19 27.26	-5 52 51.7	5.42	5.67	1.551 963	10 46 16
Apr. 1	23 24 01.95	-5 24 48.3	5.40	5.66	1.556 051	10 46 54

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	23 24 01.95 ^s +274.21	- 5 24 48.3 +1692.6	5.40	5.66	1.556 051 + 4 051	10 46 54
2	23 28 36.16 273.74	4 56 35.7 1701.1	5.39	5.64	.560 102 4 012	10 47 32
3	23 33 09.90 273.32	4 28 14.6 1708.8	5.38	5.63	.564 114 3 974	10 48 09
4	23 37 43.22 272.93	3 59 45.8 1716.0	5.36	5.61	.568 088 3 936	10 48 45
5	23 42 16.15 272.57	3 31 09.8 1722.2	5.35	5.60	.572 024 3 898	10 49 21
6	23 46 48.72 +272.27	- 3 02 27.6 +1728.0	5.34	5.58	1.575 922 + 3 860	10 49 57
7	23 51 20.99 271.99	2 33 39.6 1733.0	5.32	5.57	.579 782 3 821	10 50 33
8	23 55 52.98 271.76	2 04 46.6 1737.3	5.31	5.56	.583 603 3 783	10 51 08
9	0 00 24.74 271.57	1 35 49.3 1740.9	5.30	5.54	.587 386 3 744	10 51 43
10	0 04 56.31 271.41	1 06 48.4 1743.8	5.29	5.53	.591 130 3 706	10 52 18
11	0 09 27.72 +271.31	- 0 37 44.6 +1746.1	5.27	5.52	1.594 836 + 3 666	10 52 53
12	0 13 59.03 271.24	- 0 08 38.5 1747.7	5.26	5.51	.598 502 3 628	10 53 28
13	0 18 30.27 271.22	+ 0 20 29.2 1748.6	5.25	5.49	.602 130 3 587	10 54 03
14	0 23 01.49 271.23	0 49 37.8 1748.8	5.24	5.48	.605 717 3 547	10 54 37
15	0 27 32.72 271.30	1 18 46.6 1748.4	5.23	5.47	.609 264 3 506	10 55 12
16	0 32 04.02 +271.40	+ 1 47 55.0 +1747.2	5.21	5.46	1.612 770 + 3 464	10 55 47
17	0 36 35.42 271.53	2 17 02.2 1745.3	5.20	5.44	.616 234 3 423	10 56 22
18	0 41 06.95 271.71	2 46 07.5 1742.8	5.19	5.43	.619 657 3 379	10 56 57
19	0 45 38.66 271.92	3 15 10.3 1739.4	5.18	5.42	.623 036 3 336	10 57 32
20	0 50 10.58 272.17	3 44 09.7 1735.5	5.17	5.41	.626 372 3 292	10 58 08
21	0 54 42.75 +272.46	+ 4 13 05.2 +1730.8	5.16	5.40	1.629 664 + 3 247	10 58 43
22	0 59 15.21 272.78	4 41 56.0 1725.4	5.15	5.39	.632 911 3 202	10 59 19
23	1 03 47.99 273.15	5 10 41.4 1719.3	5.14	5.38	.636 113 3 157	10 59 56
24	1 08 21.14 273.55	5 39 20.7 1712.5	5.13	5.37	.639 270 3 111	11 00 33
25	1 12 54.69 273.99	6 07 53.2 1705.0	5.12	5.36	.642 381 3 065	11 01 10
26	1 17 28.68 +274.45	+ 6 36 18.2 +1696.7	5.11	5.35	1.645 446 + 3 019	11 01 47
27	1 22 03.13 274.97	7 04 34.9 1687.8	5.10	5.34	.648 465 2 971	11 02 26
28	1 26 38.10 275.50	7 32 42.7 1678.1	5.09	5.33	.651 436 2 925	11 03 04
29	1 31 13.60 276.09	8 00 40.8 1667.7	5.08	5.32	.654 361 2 879	11 03 44
30	1 35 49.69 276.69	8 28 28.5 1656.6	5.07	5.31	.657 240 2 831	11 04 23
May 1	1 40 26.38 +277.34	+ 8 56 05.1 +1644.8	5.07	5.30	1.660 071 + 2 783	11 05 04
2	1 45 03.72 278.01	9 23 29.9 1632.3	5.06	5.29	.662 854 2 737	11 05 45
3	1 49 41.73 278.71	9 50 42.2 1618.9	5.05	5.28	.665 591 2 689	11 06 27
4	1 54 20.44 279.46	10 17 41.1 1605.0	5.04	5.27	.668 280 2 641	11 07 09
5	1 58 59.90 280.24	10 44 26.1 1590.3	5.03	5.27	.670 921 2 594	11 07 53
6	2 03 40.14 +281.03	+11 10 56.4 +1574.9	5.03	5.26	1.673 515 + 2 546	11 08 37
7	2 08 21.17 281.87	11 37 11.3 1558.7	5.02	5.25	.676 061 2 498	11 09 21
8	2 13 03.04 282.73	12 03 10.0 1541.8	5.01	5.24	.678 559 2 450	11 10 07
9	2 17 45.77 283.64	12 28 51.8 1524.3	5.00	5.23	.681 009 2 402	11 10 54
10	2 22 29.41 284.55	12 54 16.1 1505.9	5.00	5.23	.683 411 2 354	11 11 41
11	2 27 13.96 +285.51	+13 19 22.0 +1487.0	4.99	5.22	1.685 765 + 2 305	11 12 30
12	2 31 59.47 286.50	13 44 09.0 1467.3	4.98	5.21	.688 070 2 257	11 13 19
13	2 36 45.97 287.49	14 08 36.3 1446.8	4.98	5.21	.690 327 2 206	11 14 10
14	2 41 33.46 288.52	14 32 43.1 1425.6	4.97	5.20	.692 533 2 157	11 15 01
15	2 46 21.98 289.56	14 56 28.7 1403.8	4.96	5.19	.694 690 2 106	11 15 54
16	2 51 11.54 +290.61	+15 19 52.5 +1381.1	4.96	5.19	1.696 796 + 2 054	11 16 47
17	2 56 02.15	+15 42 53.6	4.95	5.18	1.698 850	11 17 42

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	2 56 02.15 ^s	+15 42 53.6	4.95	5.18	1.698 850	11 17 42
18	3 00 53.85 ^s	16 05 31.5	4.94	5.17	1.700 853	11 18 37
19	3 05 46.63	16 27 45.2	4.94	5.17	1.702 803	11 19 34
20	3 10 40.52	16 49 34.1	4.93	5.16	1.704 700	11 20 32
21	3 15 35.51	17 10 57.4	4.93	5.16	1.706 543	11 21 31
22	3 20 31.62	+17 31 54.6	4.92	5.15	1.708 332	11 22 31
23	3 25 28.86	17 52 24.8	4.92	5.15	1.710 066	11 23 33
24	3 30 27.22	18 12 27.4	4.91	5.14	1.711 746	11 24 35
25	3 35 26.71	18 32 01.5	4.91	5.14	1.713 371	11 25 38
26	3 40 27.31	18 51 06.7	4.90	5.13	1.714 939	11 26 43
27	3 45 29.04	+19 09 42.1	4.90	5.13	1.716 453	11 27 49
28	3 50 31.87	19 27 47.1	4.90	5.12	1.717 910	11 28 56
29	3 55 35.81	19 45 21.0	4.89	5.12	1.719 311	11 30 04
30	4 00 40.83	20 02 23.1	4.89	5.11	1.720 656	11 31 13
31	4 05 46.93	20 18 52.9	4.88	5.11	1.721 945	11 32 23
June 1	4 10 54.09	+20 34 49.6	4.88	5.11	1.723 178	11 33 34
2	4 16 02.28	20 50 12.6	4.88	5.10	1.724 354	11 34 46
3	4 21 11.50	21 05 01.4	4.87	5.10	1.725 474	11 35 59
4	4 26 21.72	21 19 15.2	4.87	5.10	1.726 538	11 37 14
5	4 31 32.91	21 32 53.6	4.87	5.09	1.727 546	11 38 29
6	4 36 45.06	+21 45 55.9	4.87	5.09	1.728 497	11 39 45
7	4 41 58.13	21 58 21.7	4.86	5.09	1.729 393	11 41 02
8	4 47 12.09	22 10 10.4	4.86	5.09	1.730 232	11 42 20
9	4 52 26.92	22 21 21.5	4.86	5.08	1.731 016	11 43 38
10	4 57 42.58	22 31 54.6	4.86	5.08	1.731 743	11 44 58
11	5 02 59.03	+22 41 49.1	4.85	5.08	1.732 414	11 46 18
12	5 08 16.24	22 51 04.7	4.85	5.08	1.733 029	11 47 39
13	5 13 34.15	22 59 40.9	4.85	5.08	1.733 587	11 49 01
14	5 18 52.74	23 07 37.4	4.85	5.07	1.734 087	11 50 24
15	5 24 11.95	23 14 53.6	4.85	5.07	1.734 530	11 51 47
16	5 29 31.74	+23 21 29.3	4.85	5.07	1.734 915	11 53 10
17	5 34 52.06	23 27 24.2	4.85	5.07	1.735 241	11 54 34
18	5 40 12.85	23 32 38.0	4.85	5.07	1.735 508	11 55 59
19	5 45 34.07	23 37 10.4	4.85	5.07	1.735 716	11 57 24
20	5 50 55.66	23 41 01.2	4.84	5.07	1.735 865	11 58 49
21	5 56 17.56	+23 44 10.2	4.84	5.07	1.735 953	12 00 15
22	6 01 39.71	23 46 37.1	4.84	5.07	1.735 982	12 01 40
23	6 07 02.06	23 48 22.0	4.84	5.07	1.735 950	12 03 06
24	6 12 24.54	23 49 24.6	4.84	5.07	1.735 858	12 04 33
25	6 17 47.09	23 49 44.9	4.85	5.07	1.735 706	12 05 59
26	6 23 09.66	+23 49 22.7	4.85	5.07	1.735 493	12 07 25
27	6 28 32.18	23 48 18.2	4.85	5.07	1.735 221	12 08 51
28	6 33 54.59	23 46 31.3	4.85	5.07	1.734 888	12 10 16
29	6 39 16.83	23 44 02.0	4.85	5.07	1.734 495	12 11 42
30	6 44 38.84	23 40 50.4	4.85	5.07	1.734 041	12 13 08
July 1	6 50 00.56	+23 36 56.6	4.85	5.08	1.733 528	12 14 33
2	6 55 21.94	+23 32 20.8	4.85	5.08	1.732 956	12 15 57

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	6 50 00.56 ^s	+23 36 56.6 ["]	4.85	5.08	1.733 528	12 14 33
2	6 55 21.94 ^s	23 32 20.8 ["]	4.85	5.08	.732 956	12 15 57
3	7 00 42.91 ^s	23 27 03.1 ["]	4.85	5.08	.732 324	12 17 22
4	7 06 03.43 ^s	23 21 03.6 ["]	4.86	5.08	.731 634	12 18 45
5	7 11 23.45 ^s	23 14 22.7 ["]	4.86	5.08	.730 884	12 20 09
6	7 16 42.90 ^s	+23 07 00.5 ["]	4.86	5.09	1.730 077	12 21 31
7	7 22 01.75 ^s	22 58 57.4 ["]	4.86	5.09	.729 212	12 22 53
8	7 27 19.95 ^s	22 50 13.7 ["]	4.87	5.09	.728 290	12 24 15
9	7 32 37.44 ^s	22 40 49.6 ["]	4.87	5.09	.727 310	12 25 35
10	7 37 54.19 ^s	22 30 45.6 ["]	4.87	5.10	.726 273	12 26 55
11	7 43 10.15 ^s	+22 20 02.1 ["]	4.87	5.10	1.725 179	12 28 14
12	7 48 25.28 ^s	22 08 39.4 ["]	4.88	5.10	.724 028	12 29 32
13	7 53 39.55 ^s	21 56 37.9 ["]	4.88	5.11	.722 821	12 30 50
14	7 58 52.93 ^s	21 43 58.1 ["]	4.89	5.11	.721 556	12 32 06
15	8 04 05.37 ^s	21 30 40.5 ["]	4.89	5.12	.720 234	12 33 22
16	8 09 16.86 ^s	+21 16 45.5 ["]	4.89	5.12	1.718 854	12 34 36
17	8 14 27.35 ^s	21 02 13.8 ["]	4.90	5.12	.717 417	12 35 50
18	8 19 36.83 ^s	20 47 05.7 ["]	4.90	5.13	.715 922	12 37 02
19	8 24 45.26 ^s	20 31 21.9 ["]	4.91	5.13	.714 369	12 38 13
20	8 29 52.63 ^s	20 15 03.0 ["]	4.91	5.14	.712 759	12 39 24
21	8 34 58.90 ^s	+19 58 09.6 ["]	4.91	5.14	1.711 091	12 40 33
22	8 40 04.07 ^s	19 40 42.2 ["]	4.92	5.15	.709 366	12 41 41
23	8 45 08.10 ^s	19 22 41.4 ["]	4.93	5.15	.707 583	12 42 48
24	8 50 10.99 ^s	19 04 08.0 ["]	4.93	5.16	.705 743	12 43 54
25	8 55 12.73 ^s	18 45 02.6 ["]	4.94	5.16	.703 846	12 44 58
26	9 00 13.30 ^s	+18 25 25.7 ["]	4.94	5.17	1.701 892	12 46 02
27	9 05 12.70 ^s	18 05 18.1 ["]	4.95	5.18	.699 881	12 47 04
28	9 10 10.91 ^s	17 44 40.5 ["]	4.95	5.18	.697 814	12 48 05
29	9 15 07.95 ^s	17 23 33.5 ["]	4.96	5.19	.695 692	12 49 05
30	9 20 03.80 ^s	17 01 57.8 ["]	4.97	5.20	.693 513	12 50 04
31	9 24 58.48 ^s	+16 39 54.1 ["]	4.97	5.20	1.691 280	12 51 01
Aug. 1	9 29 51.99 ^s	16 17 23.1 ["]	4.98	5.21	.688 992	12 51 58
2	9 34 44.33 ^s	15 54 25.5 ["]	4.99	5.22	.686 650	12 52 53
3	9 39 35.51 ^s	15 31 02.0 ["]	4.99	5.22	.684 255	12 53 47
4	9 44 25.55 ^s	15 07 13.4 ["]	5.00	5.23	.681 808	12 54 40
5	9 49 14.46 ^s	+14 43 00.4 ["]	5.01	5.24	1.679 308	12 55 32
6	9 54 02.26 ^s	14 18 23.7 ["]	5.02	5.25	.676 757	12 56 22
7	9 58 48.96 ^s	13 53 23.9 ["]	5.02	5.26	.674 155	12 57 12
8	10 03 34.58 ^s	13 28 01.9 ["]	5.03	5.26	.671 502	12 58 00
9	10 08 19.16 ^s	13 02 18.4 ["]	5.04	5.27	.668 800	12 58 48
10	10 13 02.70 ^s	+12 36 14.0 ["]	5.05	5.28	1.666 047	12 59 34
11	10 17 45.25 ^s	12 09 49.4 ["]	5.06	5.29	.663 246	13 00 20
12	10 22 26.83 ^s	11 43 05.5 ["]	5.07	5.30	.660 394	13 01 04
13	10 27 07.46 ^s	11 16 02.8 ["]	5.07	5.31	.657 494	13 01 48
14	10 31 47.19 ^s	10 48 42.1 ["]	5.08	5.32	.654 544	13 02 31
15	10 36 26.03 ^s	+10 21 04.2 ["]	5.09	5.33	1.651 545	13 03 12
16	10 41 04.01 ^s	+ 9 53 09.8 ["]	5.10	5.34	1.648 497	13 03 53

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	10 41 04.01 ^s	+ 9 53 09.8	5.10	5.34	1.648 497	13 03 53
17	10 45 41.18 ^s	9 24 59.6	5.11	5.35	.645 399	13 04 34
18	10 50 17.56 ^s	8 56 34.4	5.12	5.36	.642 254	13 05 13
19	10 54 53.17 ^s	8 27 54.9	5.13	5.37	.639 059	13 05 52
20	10 59 28.06 ^s	7 59 01.7	5.14	5.38	.635 816	13 06 30
21	11 04 02.26 ^s	+ 7 29 55.8	5.15	5.39	1.632 526	13 07 07
22	11 08 35.80 ^s	7 00 37.7	5.16	5.40	.629 187	13 07 44
23	11 13 08.72 ^s	6 31 08.2	5.17	5.41	.625 800	13 08 20
24	11 17 41.05 ^s	6 01 28.1	5.18	5.42	.622 367	13 08 55
25	11 22 12.83 ^s	5 31 38.0	5.19	5.44	.618 886	13 09 30
26	11 26 44.10 ^s	+ 5 01 38.8	5.21	5.45	1.615 358	13 10 05
27	11 31 14.89 ^s	4 31 31.0	5.22	5.46	.611 784	13 10 39
28	11 35 45.24 ^s	4 01 15.5	5.23	5.47	.608 164	13 11 12
29	11 40 15.19 ^s	3 30 53.0	5.24	5.48	.604 499	13 11 45
30	11 44 44.79 ^s	3 00 24.1	5.25	5.50	.600 790	13 12 18
31	11 49 14.07 ^s	+ 2 29 49.7	5.27	5.51	1.597 036	13 12 51
Sept. 1	11 53 43.07 ^s	1 59 10.4	5.28	5.52	.593 240	13 13 23
2	11 58 11.83 ^s	1 28 26.9	5.29	5.54	.589 401	13 13 55
3	12 02 40.39 ^s	0 57 40.1	5.30	5.55	.585 520	13 14 27
4	12 07 08.80 ^s	+ 0 26 50.5	5.32	5.56	.581 597	13 14 59
5	12 11 37.09 ^s	0 04 01.0	5.33	5.58	1.577 635	13 15 31
6	12 16 05.32 ^s	0 34 53.8	5.34	5.59	.573 632	13 16 02
7	12 20 33.54 ^s	1 05 47.2	5.36	5.61	.569 590	13 16 34
8	12 25 01.78 ^s	1 36 40.5	5.37	5.62	.565 509	13 17 06
9	12 29 30.09 ^s	2 07 33.0	5.39	5.64	.561 389	13 17 38
10	12 33 58.52 ^s	- 2 38 24.0	5.40	5.65	1.557 230	13 18 10
11	12 38 27.12 ^s	3 09 12.7	5.42	5.67	.553 033	13 18 42
12	12 42 55.93 ^s	3 39 58.6	5.43	5.68	.548 798	13 19 14
13	12 47 24.99 ^s	4 10 40.7	5.45	5.70	.544 525	13 19 47
14	12 51 54.34 ^s	4 41 18.5	5.46	5.71	.540 214	13 20 20
15	12 56 24.03 ^s	- 5 11 51.1	5.48	5.73	1.535 865	13 20 53
16	13 00 54.09 ^s	5 42 17.9	5.49	5.75	.531 479	13 21 27
17	13 05 24.58 ^s	6 12 38.1	5.51	5.76	.527 055	13 22 01
18	13 09 55.51 ^s	6 42 51.0	5.52	5.78	.522 594	13 22 36
19	13 14 26.95 ^s	7 12 55.8	5.54	5.80	.518 096	13 23 11
20	13 18 58.93 ^s	- 7 42 51.9	5.56	5.81	1.513 560	13 23 47
21	13 23 31.48 ^s	8 12 38.4	5.57	5.83	.508 988	13 24 23
22	13 28 04.64 ^s	8 42 14.6	5.59	5.85	.504 379	13 25 00
23	13 32 38.46 ^s	9 11 39.7	5.61	5.87	.499 734	13 25 38
24	13 37 12.96 ^s	9 40 53.1	5.63	5.89	.495 052	13 26 16
25	13 41 48.19 ^s	-10 09 53.8	5.64	5.90	1.490 334	13 26 55
26	13 46 24.17 ^s	10 38 41.3	5.66	5.92	.485 580	13 27 35
27	13 51 00.94 ^s	11 07 14.7	5.68	5.94	.480 792	13 28 16
28	13 55 38.53 ^s	11 35 33.2	5.70	5.96	.475 969	13 28 57
29	14 00 16.96 ^s	12 03 36.1	5.72	5.98	.471 112	13 29 40
30	14 04 56.28 ^s	-12 31 22.5	5.74	6.00	1.466 222	13 30 23
Oct. 1	14 09 36.51 ^s	-12 58 51.8	5.76	6.02	1.461 298	13 31 07

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct. 1	14 09 36.51 +281.16	-12 58 51.8 -1631.3	5.76	6.02	1.461 298 - 4 955	13 31 07
2	14 14 17.67 282.13	13 26 03.1 1612.6	5.77	6.04	.456 343 4 987	13 31 53
3	14 18 59.80 283.13	13 52 55.7 1593.0	5.79	6.06	.451 356 5 018	13 32 39
4	14 23 42.93 284.16	14 19 28.7 1572.8	5.81	6.08	.446 338 5 048	13 33 26
5	14 28 27.09 285.21	14 45 41.5 1551.8	5.84	6.11	.441 290 5 078	13 34 14
6	14 33 12.30 +286.29	-15 11 33.3 -1530.0	5.86	6.13	1.436 212 - 5 109	13 35 03
7	14 37 58.59 287.40	15 37 03.3 1507.4	5.88	6.15	.431 103 5 137	13 35 54
8	14 42 45.99 288.53	16 02 10.7 1484.1	5.90	6.17	.425 966 5 167	13 36 45
9	14 47 34.52 289.67	16 26 54.8 1460.0	5.92	6.19	.420 799 5 195	13 37 38
10	14 52 24.19 290.83	16 51 14.8 1435.2	5.94	6.22	.415 604 5 225	13 38 32
11	14 57 15.02 +292.01	-17 15 10.0 -1409.6	5.96	6.24	1.410 379 - 5 254	13 39 27
12	15 02 07.03 293.20	17 38 39.6 1383.1	5.99	6.26	.405 125 5 282	13 40 23
13	15 07 00.23 294.39	18 01 42.7 1356.0	6.01	6.29	.399 843 5 311	13 41 20
14	15 11 54.62 295.61	18 24 18.7 1328.1	6.03	6.31	.394 532 5 340	13 42 19
15	15 16 50.23 296.81	18 46 26.8 1299.5	6.05	6.33	.389 192 5 368	13 43 19
16	15 21 47.04 +298.02	-19 08 06.3 -1269.9	6.08	6.36	1.383 824 - 5 397	13 44 20
17	15 26 45.06 299.24	19 29 16.2 1239.8	6.10	6.38	.378 427 5 425	13 45 22
18	15 31 44.30 300.45	19 49 56.0 1208.9	6.13	6.41	.373 002 5 454	13 46 25
19	15 36 44.75 301.65	20 10 04.9 1177.2	6.15	6.43	.367 548 5 483	13 47 30
20	15 41 46.40 302.85	20 29 42.1 1144.8	6.17	6.46	.362 065 5 512	13 48 36
21	15 46 49.25 +304.02	-20 48 46.9 -1111.8	6.20	6.49	1.356 553 - 5 540	13 49 43
22	15 51 53.27 305.19	21 07 18.7 1077.9	6.22	6.51	.351 013 5 569	13 50 51
23	15 56 58.46 306.34	21 25 16.6 1043.4	6.25	6.54	.345 444 5 597	13 52 00
24	16 02 04.80 307.45	21 42 40.0 1008.2	6.28	6.57	.339 847 5 626	13 53 11
25	16 07 12.25 308.54	21 59 28.2 972.4	6.30	6.60	.334 221 5 654	13 54 22
26	16 12 20.79 +309.60	-22 15 40.6 -935.8	6.33	6.62	1.328 567 - 5 681	13 55 35
27	16 17 30.39 310.64	22 31 16.4 898.8	6.36	6.65	.322 886 5 709	13 56 49
28	16 22 41.03 311.62	22 46 15.2 860.9	6.38	6.68	.317 177 5 735	13 58 03
29	16 27 52.65 312.59	23 00 36.1 822.5	6.41	6.71	.311 442 5 761	13 59 19
30	16 33 05.24 313.50	23 14 18.6 783.5	6.44	6.74	.305 681 5 787	14 00 36
31	16 38 18.74 +314.39	-23 27 22.1 -744.0	6.47	6.77	1.299 894 - 5 813	14 01 53
Nov. 1	16 43 33.13 315.23	23 39 46.1 703.9	6.50	6.80	.294 081 5 837	14 03 12
2	16 48 48.36 316.03	23 51 30.0 663.4	6.53	6.83	.288 244 5 861	14 04 31
3	16 54 04.39 316.78	24 02 33.4 622.3	6.56	6.86	.282 383 5 886	14 05 51
4	16 59 21.17 317.49	24 12 55.7 580.8	6.59	6.89	.276 497 5 909	14 07 12
5	17 04 38.66 +318.14	-24 22 36.5 -539.0	6.62	6.93	1.270 588 - 5 933	14 08 33
6	17 09 56.80 318.75	24 31 35.5 496.6	6.65	6.96	.264 655 5 957	14 09 55
7	17 15 15.55 319.28	24 39 52.1 454.0	6.68	6.99	.258 698 5 979	14 11 18
8	17 20 34.83 319.77	24 47 26.1 410.9	6.71	7.02	.252 719 6 003	14 12 41
9	17 25 54.60 320.20	24 54 17.0 367.6	6.75	7.06	.246 716 6 026	14 14 04
10	17 31 14.80 +320.56	-25 00 24.6 -324.0	6.78	7.09	1.240 690 - 6 048	14 15 28
11	17 36 35.36 320.86	25 05 48.6 280.2	6.81	7.13	.234 642 6 072	14 16 53
12	17 41 56.22 321.10	25 10 28.8 236.1	6.85	7.16	.228 570 6 095	14 18 17
13	17 47 17.32 321.26	25 14 24.9 191.8	6.88	7.20	.222 475 6 118	14 19 42
14	17 52 38.58 321.36	25 17 36.7 147.4	6.91	7.23	.216 357 6 142	14 21 07
15	17 57 59.94 +321.40	-25 20 04.1 -102.9	6.95	7.27	1.210 215 - 6 164	14 22 32
16	18 03 21.34	-25 21 47.0	6.98	7.31	1.204 051	14 23 57

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	18 03 21.34	-25 21 47.0	6.98	7.31	1.204 051	14 23 57
17	18 08 42.69	25 22 45.3	7.02	7.35	1.197 863	14 25 21
18	18 14 03.94	25 22 59.0	7.06	7.38	1.191 651	14 26 46
19	18 19 25.01	25 22 28.1	7.09	7.42	1.185 415	14 28 11
20	18 24 45.82	25 21 12.5	7.13	7.46	1.179 156	14 29 35
21	18 30 06.30	-25 19 12.4	7.17	7.50	1.172 872	14 30 59
22	18 35 26.36	25 16 28.0	7.21	7.54	1.166 565	14 32 22
23	18 40 45.94	25 12 59.2	7.25	7.58	1.160 233	14 33 45
24	18 46 04.95	25 08 46.4	7.29	7.63	1.153 878	14 35 07
25	18 51 23.33	25 03 49.6	7.33	7.67	1.147 499	14 36 28
26	18 56 40.99	-24 58 09.2	7.37	7.71	1.141 097	14 37 49
27	19 01 57.87	24 51 45.4	7.41	7.76	1.134 672	14 39 09
28	19 07 13.90	24 44 38.4	7.45	7.80	1.128 225	14 40 28
29	19 12 29.02	24 36 48.8	7.50	7.84	1.121 756	14 41 46
30	19 17 43.16	24 28 16.6	7.54	7.89	1.115 266	14 43 03
Dec. 1	19 22 56.28	-24 19 02.6	7.59	7.94	1.108 754	14 44 19
2	19 28 08.30	24 09 06.9	7.63	7.98	1.102 222	14 45 34
3	19 33 19.17	23 58 30.1	7.68	8.03	1.095 669	14 46 47
4	19 38 28.84	23 47 12.8	7.72	8.08	1.089 095	14 48 00
5	19 43 37.26	23 35 15.2	7.77	8.13	1.082 503	14 49 11
6	19 48 44.39	-23 22 38.1	7.82	8.18	1.075 890	14 50 21
7	19 53 50.16	23 09 22.0	7.87	8.23	1.069 258	14 51 29
8	19 58 54.56	22 55 27.5	7.91	8.28	1.062 606	14 52 36
9	20 03 57.52	22 40 55.0	7.96	8.33	1.055 935	14 53 42
10	20 08 59.02	22 25 45.4	8.02	8.39	1.049 245	14 54 46
11	20 13 59.02	-22 09 59.0	8.07	8.44	1.042 536	14 55 48
12	20 18 57.49	21 53 36.8	8.12	8.50	1.035 808	14 56 49
13	20 23 54.40	21 36 39.3	8.17	8.55	1.029 061	14 57 49
14	20 28 49.72	21 19 07.1	8.23	8.61	1.022 294	14 58 46
15	20 33 43.42	21 01 01.1	8.28	8.67	1.015 508	14 59 43
16	20 38 35.50	-20 42 21.8	8.34	8.72	1.008 703	15 00 37
17	20 43 25.91	20 23 10.1	8.39	8.78	1.001 878	15 01 30
18	20 48 14.65	20 03 26.6	8.45	8.84	0.995 034	15 02 21
19	20 53 01.69	19 43 12.3	8.51	8.91	0.988 169	15 03 10
20	20 57 47.00	19 22 27.8	8.57	8.97	0.981 284	15 03 58
21	21 02 30.57	-19 01 13.9	8.63	9.03	0.974 379	15 04 44
22	21 07 12.38	18 39 31.4	8.69	9.10	0.967 455	15 05 28
23	21 11 52.41	18 17 21.3	8.76	9.16	0.960 510	15 06 11
24	21 16 30.66	17 54 44.0	8.82	9.23	0.953 546	15 06 51
25	21 21 07.10	17 31 40.7	8.88	9.30	0.946 562	15 07 30
26	21 25 41.73	-17 08 12.0	8.95	9.37	0.939 560	15 08 07
27	21 30 14.55	16 44 18.7	9.02	9.44	0.932 540	15 08 42
28	21 34 45.56	16 20 01.6	9.09	9.51	0.925 502	15 09 15
29	21 39 14.75	15 55 21.6	9.16	9.58	0.918 446	15 09 47
30	21 43 42.13	15 30 19.5	9.23	9.66	0.911 373	15 10 17
31	21 48 07.69	-15 04 56.1	9.30	9.73	0.904 284	15 10 44
32	21 52 31.44	14 39 12.2	9.37	9.81	0.897 179	15 11 10

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	17 14 31.72 +189.95	-23 23 27.9 - 236.8	1.95	3.67	2.401 004 - 4 020	10 39 29
1	17 17 41.67 190.31	23 27 24.7 222.8	1.95	3.67	.396 984 4 049	10 38 43
2	17 20 51.98 190.65	23 31 07.5 208.8	1.96	3.68	.392 935 4 077	10 37 57
3	17 24 02.63 190.98	23 34 36.3 194.5	1.96	3.68	.388 858 4 105	10 37 11
4	17 27 13.61 191.31	23 37 50.8 180.4	1.96	3.69	.384 753 4 132	10 36 26
5	17 30 24.92 +191.63	-23 40 51.2 - 166.0	1.97	3.70	2.380 621 - 4 158	10 35 41
6	17 33 36.55 191.93	23 43 37.2 151.5	1.97	3.70	.376 463 4 183	10 34 56
7	17 36 48.48 192.23	23 46 08.7 137.1	1.97	3.71	.372 280 4 208	10 34 11
8	17 40 00.71 192.51	23 48 25.8 122.5	1.98	3.72	.368 072 4 231	10 33 27
9	17 43 13.22 192.78	23 50 28.3 107.9	1.98	3.72	.363 841 4 255	10 32 43
10	17 46 26.00 +193.04	-23 52 16.2 - 93.2	1.98	3.73	2.359 586 - 4 277	10 32 00
11	17 49 39.04 193.29	23 53 49.4 78.5	1.99	3.74	.355 309 4 299	10 31 16
12	17 52 52.33 193.52	23 55 07.9 63.7	1.99	3.74	.351 010 4 321	10 30 33
13	17 56 05.85 193.75	23 56 11.6 48.8	1.99	3.75	.346 689 4 342	10 29 50
14	17 59 19.60 193.96	23 57 00.4 33.9	2.00	3.76	.342 347 4 363	10 29 07
15	18 02 33.56 +194.17	-23 57 34.3 - 18.9	2.00	3.76	2.337 984 - 4 382	10 28 25
16	18 05 47.73 194.35	23 57 53.2 - 3.9	2.01	3.77	.333 602 4 403	10 27 43
17	18 09 02.08 194.52	23 57 57.1 + 11.1	2.01	3.78	.329 199 4 423	10 27 01
18	18 12 16.60 194.69	23 57 46.0 26.2	2.01	3.79	.324 776 4 441	10 26 19
19	18 15 31.29 194.84	23 57 19.8 41.3	2.02	3.79	.320 335 4 462	10 25 37
20	18 18 46.13 +194.98	-23 56 38.5 + 56.4	2.02	3.80	2.315 873 - 4 480	10 24 55
21	18 22 01.11 195.10	23 55 42.1 71.6	2.02	3.81	.311 393 4 499	10 24 14
22	18 25 16.21 195.22	23 54 30.5 86.8	2.03	3.81	.306 894 4 518	10 23 32
23	18 28 31.43 195.32	23 53 03.7 102.0	2.03	3.82	.302 376 4 536	10 22 51
24	18 31 46.75 195.40	23 51 21.7 117.1	2.04	3.83	.297 840 4 555	10 22 10
25	18 35 02.15 +195.46	-23 49 24.6 + 132.3	2.04	3.84	2.293 285 - 4 573	10 21 29
26	18 38 17.61 195.51	23 47 12.3 147.4	2.04	3.84	.288 712 4 590	10 20 48
27	18 41 33.12 195.54	23 44 44.9 162.6	2.05	3.85	.284 122 4 608	10 20 07
28	18 44 48.66 195.55	23 42 02.3 177.7	2.05	3.86	.279 514 4 624	10 19 26
29	18 48 04.21 195.55	23 39 04.6 192.9	2.06	3.87	.274 890 4 640	10 18 45
30	18 51 19.76 +195.52	-23 35 51.7 + 208.0	2.06	3.88	2.270 250 - 4 655	10 18 04
Feb. 1	18 54 35.28 195.50	23 32 23.7 223.1	2.07	3.88	.265 595 4 670	10 17 23
2	18 57 50.78 195.45	23 28 40.6 238.1	2.07	3.89	.260 925 4 683	10 16 42
3	19 01 06.23 195.39	23 24 42.5 253.2	2.07	3.90	.256 242 4 696	10 16 01
4	19 04 21.62 195.32	23 20 29.3 268.3	2.08	3.91	.251 546 4 708	10 15 19
5	19 07 36.94 +195.25	-23 16 01.0 + 283.1	2.08	3.92	2.246 838 - 4 720	10 14 38
6	19 10 52.19 195.15	23 11 17.9 298.1	2.09	3.92	.242 118 4 730	10 13 57
7	19 14 07.34 195.04	23 06 19.8 313.0	2.09	3.93	.237 388 4 740	10 13 15
8	19 17 22.38 194.93	23 01 06.8 327.7	2.10	3.94	.232 648 4 749	10 12 34
9	19 20 37.31 194.80	22 55 39.1 342.5	2.10	3.95	.227 899 4 759	10 11 52
10	19 23 52.11 +194.66	-22 49 56.6 + 357.2	2.11	3.96	2.223 140 - 4 766	10 11 10
11	19 27 06.77 194.51	22 43 59.4 371.8	2.11	3.97	.218 374 4 775	10 10 28
12	19 30 21.28 194.36	22 37 47.6 386.4	2.11	3.98	.213 599 4 782	10 09 46
13	19 33 35.64 194.18	22 31 21.2 400.8	2.12	3.98	.208 817 4 789	10 09 04
14	19 36 49.82 194.00	22 24 40.4 415.2	2.12	3.99	.204 028 4 796	10 08 22
15	19 40 03.82 +193.82	-22 17 45.2 + 429.6	2.13	4.00	2.199 232 - 4 803	10 07 39
	19 43 17.64	-22 10 35.6	2.13	4.01	2.194 429	10 06 56

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	19 43 17.64	-22 10 35.6	2.13	4.01	2.194 429	10 06 56
16	19 46 31.26	22 03 11.8	2.14	4.02	1.89 621	10 06 13
17	19 49 44.67	21 55 33.8	2.14	4.03	1.84 805	10 05 30
18	19 52 57.88	21 47 41.7	2.15	4.04	1.79 984	10 04 47
19	19 56 10.86	21 39 35.7	2.15	4.05	1.75 157	10 04 03
20	19 59 23.61	-21 31 15.8	2.16	4.05	2.170 324	10 03 19
21	20 02 36.12	21 22 42.1	2.16	4.06	1.65 485	10 02 35
22	20 05 48.39	21 13 54.9	2.17	4.07	1.60 640	10 01 51
23	20 09 00.39	21 04 54.1	2.17	4.08	1.55 789	10 01 06
24	20 12 12.11	20 55 40.0	2.18	4.09	1.50 933	10 00 21
25	20 15 23.55	-20 46 12.6	2.18	4.10	2.146 072	9 59 36
26	20 18 34.69	20 36 32.1	2.19	4.11	1.41 205	9 58 50
27	20 21 45.52	20 26 38.6	2.19	4.12	1.36 335	9 58 04
28	20 24 56.04	20 16 32.2	2.20	4.13	1.31 461	9 57 18
29	20 28 06.24	20 06 13.0	2.20	4.14	1.26 584	9 56 32
Mar. 1	20 31 16.11	-19 55 41.3	2.21	4.15	2.121 704	9 55 45
2	20 34 25.65	19 44 57.1	2.21	4.16	1.16 823	9 54 58
3	20 37 34.85	19 34 00.5	2.22	4.17	1.11 940	9 54 11
4	20 40 43.70	19 22 51.7	2.22	4.18	1.07 057	9 53 23
5	20 43 52.21	19 11 31.0	2.23	4.19	1.02 174	9 52 35
6	20 47 00.37	-18 59 58.3	2.23	4.20	2.097 291	9 51 46
7	20 50 08.17	18 48 13.8	2.24	4.21	0.92 409	9 50 57
8	20 53 15.61	18 36 17.8	2.24	4.22	0.87 529	9 50 08
9	20 56 22.69	18 24 10.4	2.25	4.23	0.82 651	9 49 18
10	20 59 29.40	18 11 51.7	2.25	4.24	0.77 774	9 48 28
11	21 02 35.75	-17 59 21.8	2.26	4.25	2.072 901	9 47 38
12	21 05 41.73	17 46 41.0	2.26	4.26	0.68 030	9 46 47
13	21 08 47.35	17 33 49.3	2.27	4.27	0.63 163	9 45 56
14	21 11 52.59	17 20 47.0	2.27	4.28	0.58 298	9 45 05
15	21 14 57.48	17 07 34.1	2.28	4.29	0.53 438	9 44 13
16	21 18 02.00	-16 54 10.9	2.28	4.30	2.048 580	9 43 21
17	21 21 06.15	16 40 37.5	2.29	4.31	0.43 726	9 42 28
18	21 24 09.95	16 26 54.0	2.30	4.32	0.38 874	9 41 35
19	21 27 13.38	16 13 00.8	2.30	4.33	0.34 026	9 40 42
20	21 30 16.45	15 58 57.8	2.31	4.34	0.29 181	9 39 49
21	21 33 19.15	-15 44 45.4	2.31	4.35	2.024 338	9 38 55
22	21 36 21.49	15 30 23.7	2.32	4.36	0.19 498	9 38 00
23	21 39 23.45	15 15 53.0	2.32	4.37	0.14 661	9 37 06
24	21 42 25.04	15 01 13.3	2.33	4.38	0.09 826	9 36 11
25	21 45 26.25	14 46 25.0	2.33	4.39	0.04 994	9 35 15
26	21 48 27.09	-14 31 28.0	2.34	4.40	2.000 166	9 34 19
27	21 51 27.55	14 16 22.8	2.35	4.41	1.995 341	9 33 23
28	21 54 27.64	14 01 09.4	2.35	4.42	0.990 519	9 32 27
29	21 57 27.36	13 45 48.0	2.36	4.43	0.85 702	9 31 30
30	22 00 26.70	13 30 18.7	2.36	4.44	0.80 889	9 30 32
31	22 03 25.68	-13 14 42.0	2.37	4.45	1.976 081	9 29 35
Apr. 1	22 06 24.29	-12 58 57.7	2.37	4.46	1.971 279	9 28 37

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	22 06 24.29 ^s +178.25	-12 58 57.7 + 951.4	2.37 2.38	4.46 4.47	1.971 279 - 4 797	9 28 37 9 27 38
2	22 09 22.54 177.88	12 43 06.3 958.5	2.38 2.39	4.47 4.49	.966 482 4 791	9 27 38 9 26 39
3	22 12 20.42 177.53	12 27 07.8 965.3	2.39 2.39	4.49 4.50	.961 691 4 784	9 26 39 9 25 40
4	22 15 17.95 177.18	12 11 02.5 971.9	2.39 2.40	4.50 4.51	.956 907 4 777	9 25 40 9 24 41
5	22 18 15.13 176.83	11 54 50.6 978.5	2.40 2.40	4.51 4.52	.952 130 4 771	9 24 41 9 23 41
6	22 21 11.96 +176.48	-11 38 32.1 + 984.7	2.40 2.41	4.52 4.53	1.947 359 - 4 763	9 23 41 9 22 41
7	22 24 08.44 176.14	11 22 07.4 990.8	2.41 2.42	4.53 4.54	.942 596 4 756	9 22 41 9 21 40
8	22 27 04.58 175.81	11 05 36.6 996.8	2.42 2.42	4.54 4.55	.937 840 4 749	9 21 40 9 20 39
9	22 30 00.39 175.49	10 48 59.8 1002.5	2.42 2.43	4.55 4.56	.933 091 4 741	9 20 39 9 19 38
10	22 32 55.88 175.17	10 32 17.3 1008.1	2.43 2.43	4.56 4.57	.928 350 4 733	9 19 38 9 18 37
11	22 35 51.05 +174.85	-10 15 29.2 +1013.5	2.43 2.44	4.57 4.59	1.923 617 - 4 725	9 18 37 9 17 35
12	22 38 45.90 174.56	9 58 35.7 1018.7	2.44 2.44	4.59 4.60	.918 892 4 718	9 17 35 9 16 33
13	22 41 40.46 174.26	9 41 37.0 1023.8	2.44 2.45	4.60 4.61	.914 174 4 712	9 16 33 9 15 31
14	22 44 34.72 173.98	9 24 33.2 1028.6	2.45 2.46	4.61 4.62	.909 462 4 704	9 15 31 9 14 28
15	22 47 28.70 173.68	9 07 24.6 1033.3	2.46 2.46	4.62 4.63	.904 758 4 698	9 14 28 9 13 25
16	22 50 22.38 +173.42	- 8 50 11.3 +1037.7	2.46 2.47	4.63 4.64	1.900 060 - 4 692	9 13 25 9 12 22
17	22 53 15.80 173.13	8 32 53.6 1042.0	2.47 2.48	4.64 4.65	.895 368 4 686	9 12 22 9 11 18
18	22 56 08.93 172.87	8 15 31.6 1046.0	2.48 2.48	4.65 4.67	.890 682 4 681	9 11 18 9 10 15
19	22 59 01.80 172.59	7 58 05.6 1049.9	2.48 2.49	4.67 4.68	.886 001 4 675	9 10 15 9 09 11
20	23 01 54.39 172.32	7 40 35.7 1053.5	2.49 2.49	4.68 4.69	.881 326 4 671	9 09 11 9 08 06
21	23 04 46.71 +172.07	- 7 23 02.2 +1057.0	2.49 2.50	4.69 4.70	1.876 655 - 4 667	9 08 06 9 07 02
22	23 07 38.78 171.80	7 05 25.2 1060.2	2.50 2.51	4.70 4.71	.871 988 4 661	9 07 02 9 05 57
23	23 10 30.58 171.55	6 47 45.0 1063.3	2.51 2.51	4.71 4.72	.867 327 4 656	9 05 57 9 04 52
24	23 13 22.13 171.31	6 30 01.7 1066.2	2.51 2.52	4.72 4.74	.862 671 4 652	9 04 52 9 03 47
25	23 16 13.44 171.05	6 12 15.5 1068.9	2.52 2.53	4.74 4.75	.858 019 4 647	9 03 47 9 02 41
26	23 19 04.49 +170.82	- 5 54 26.6 +1071.3	2.53 2.53	4.75 4.76	1.853 372 - 4 642	9 02 41 9 01 35
27	23 21 55.31 170.59	5 36 35.3 1073.7	2.53 2.54	4.76 4.77	.848 730 4 637	9 01 35 9 00 29
28	23 24 45.90 170.35	5 18 41.6 1075.7	2.54 2.54	4.77 4.78	.844 093 4 631	9 00 29 8 59 23
29	23 27 36.25 170.14	5 00 45.9 1077.6	2.54 2.55	4.78 4.80	.839 462 4 626	8 59 23 8 58 17
30	23 30 26.39 169.91	4 42 48.3 1079.4	2.55 2.56	4.80 4.81	.834 836 4 620	8 58 17 8 57 10
May 1	23 33 16.30 +169.70	- 4 24 48.9 +1080.9	2.56 2.56	4.81 4.82	1.830 216 - 4 615	8 57 10 8 56 03
2	23 36 06.00 169.50	4 06 48.0 1082.2	2.56 2.57	4.82 4.83	.825 601 4 608	8 56 03 8 54 56
3	23 38 55.50 169.29	3 48 45.8 1083.3	2.57 2.58	4.83 4.84	.820 993 4 603	8 54 56 8 53 49
4	23 41 44.79 169.10	3 30 42.5 1084.4	2.58 2.58	4.84 4.86	.816 390 4 596	8 53 49 8 52 41
5	23 44 33.89 168.92	3 12 38.1 1085.1	2.58 2.59	4.86 4.87	.811 794 4 591	8 52 41 8 51 34
6	23 47 22.81 +168.74	- 2 54 33.0 +1085.7	2.59 2.60	4.87 4.88	1.807 203 - 4 584	8 51 34 8 50 26
7	23 50 11.55 168.57	2 36 27.3 1086.2	2.60 2.60	4.88 4.89	.802 619 4 578	8 50 26 8 49 18
8	23 53 00.12 168.41	2 18 21.1 1086.5	2.60 2.61	4.89 4.91	.798 041 4 572	8 49 18 8 48 10
9	23 55 48.53 168.27	2 00 14.6 1086.6	2.61 2.62	4.91 4.92	.793 469 4 567	8 48 10 8 47 01
10	23 58 36.80 168.12	1 42 08.0 1086.6	2.62 2.62	4.92 4.93	.788 902 4 561	8 47 01 8 45 53
11	0 01 24.92 +167.99	- 1 24 01.4 +1086.3	2.62 2.63	4.93 4.94	1.784 341 - 4 555	8 45 53 8 44 45
12	0 04 12.91 167.88	1 05 55.1 1086.0	2.63 2.64	4.94 4.96	.779 786 4 552	8 44 45 8 43 36
13	0 07 00.79 167.75	0 47 49.1 1085.3	2.64 2.64	4.96 4.97	.775 234 4 547	8 43 36 8 42 27
14	0 09 48.54 167.65	0 29 43.8 1084.7	2.64 2.65	4.97 4.98	.770 687 4 544	8 42 27 8 41 18
15	0 12 36.19 167.54	- 0 11 39.1 1083.6	2.65 2.66	4.98 5.00	.766 143 4 541	8 41 18 8 40 09
16	0 15 23.73 +167.43	+ 0 06 24.5 +1082.6	2.66 2.66	5.00 5.01	1.761 602 - 4 539	8 40 09 8 39 00
17	0 18 11.16	+ 0 24 27.1			1.757 063	

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FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	0 18 11.16	+ 0 24 27.1	2.66	5.01	1.757 063	8 39 00
18	0 20 58.49	0 42 28.3	2.67	5.02	.752 525	8 37 51
19	0 23 45.73	1 00 28.0	2.68	5.03	.747 989	8 36 42
20	0 26 32.88	1 18 26.0	2.68	5.05	.743 454	8 35 32
21	0 29 19.94	1 36 22.2	2.69	5.06	.738 920	8 34 23
22	0 32 06.91	+ 1 54 16.3	2.70	5.07	1.734 386	8 33 13
23	0 34 53.81	2 12 08.1	2.71	5.09	.729 852	8 32 03
24	0 37 40.64	2 29 57.6	2.71	5.10	.725 318	8 30 54
25	0 40 27.39	2 47 44.5	2.72	5.11	.720 785	8 29 44
26	0 43 14.07	3 05 28.6	2.73	5.13	.716 251	8 28 34
27	0 46 00.69	+ 3 23 09.7	2.73	5.14	1.711 717	8 27 24
28	0 48 47.24	3 40 47.8	2.74	5.15	.707 183	8 26 14
29	0 51 33.74	3 58 22.5	2.75	5.17	.702 649	8 25 04
30	0 54 20.19	4 15 53.8	2.76	5.18	.698 115	8 23 54
31	0 57 06.58	4 33 21.5	2.76	5.20	.693 580	8 22 44
June 1	0 59 52.93	+ 4 50 45.4	2.77	5.21	1.689 046	8 21 34
2	1 02 39.24	5 08 05.3	2.78	5.22	.684 511	8 20 24
3	1 05 25.52	5 25 21.0	2.79	5.24	.679 975	8 19 13
4	1 08 11.76	5 42 32.5	2.79	5.25	.675 439	8 18 03
5	1 10 57.98	5 59 39.6	2.80	5.27	.670 903	8 16 53
6	1 13 44.19	+ 6 16 42.1	2.81	5.28	1.666 366	8 15 43
7	1 16 30.39	6 33 39.9	2.82	5.30	.661 828	8 14 32
8	1 19 16.59	6 50 32.9	2.82	5.31	.657 288	8 13 22
9	1 22 02.80	7 07 20.9	2.83	5.32	.652 747	8 12 12
10	1 24 49.01	7 24 03.8	2.84	5.34	.648 203	8 11 02
11	1 27 35.24	+ 7 40 41.5	2.85	5.35	1.643 657	8 09 51
12	1 30 21.49	7 57 13.7	2.86	5.37	.639 106	8 08 41
13	1 33 07.75	8 13 40.3	2.86	5.38	.634 551	8 07 31
14	1 35 54.04	8 30 01.2	2.87	5.40	.629 991	8 06 21
15	1 38 40.34	8 46 16.2	2.88	5.41	.625 424	8 05 10
16	1 41 26.67	+ 9 02 25.1	2.89	5.43	1.620 852	8 04 00
17	1 44 13.01	9 18 27.8	2.90	5.44	.616 272	8 02 50
18	1 46 59.38	9 34 24.2	2.90	5.46	.611 684	8 01 40
19	1 49 45.77	9 50 14.1	2.91	5.48	.607 089	8 00 30
20	1 52 32.18	10 05 57.4	2.92	5.49	.602 486	7 59 20
21	1 55 18.61	+ 10 21 33.9	2.93	5.51	1.597 874	7 58 10
22	1 58 05.05	10 37 03.5	2.94	5.52	.593 254	7 57 00
23	2 00 51.52	10 52 26.0	2.95	5.54	.588 625	7 55 50
24	2 03 37.99	11 07 41.3	2.95	5.56	.583 986	7 54 40
25	2 06 24.48	11 22 49.3	2.96	5.57	.579 339	7 53 30
26	2 09 10.97	+ 11 37 49.8	2.97	5.59	1.574 682	7 52 20
27	2 11 57.48	11 52 42.7	2.98	5.61	.570 016	7 51 10
28	2 14 43.99	12 07 27.8	2.99	5.62	.565 340	7 50 00
29	2 17 30.51	12 22 05.0	3.00	5.64	.560 655	7 48 50
30	2 20 17.03	12 36 34.3	3.01	5.66	.555 960	7 47 40
July 1	2 23 03.56	+ 12 50 55.4	3.02	5.67	1.551 256	7 46 30
2	2 25 50.09	+ 13 05 08.3	3.03	5.69	1.546 541	7 45 20

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	2 23 03.56 ^s +166.53	+12 50 55.4 ^s 13 05 08.3 ^s + 852.9	3.02	5.67	1.551 256 - 4 715	7 46 30
2	2 25 50.09 166.53	13 05 08.3 844.6	3.03	5.69	.546 541 4 724	7 45 20
3	2 28 36.62 166.55	13 19 12.9 836.2	3.04	5.71	.541 817 4 734	7 44 10
4	2 31 23.17 166.55	13 33 09.1 827.7	3.04	5.73	.537 083 4 745	7 43 00
5	2 34 09.72 166.56	13 46 56.8 819.0	3.05	5.74	.532 338 4 755	7 41 50
6	2 36 56.28 +166.56	+14 00 35.8 14 14 06.1 ^s + 810.3	3.06	5.76	1.527 583 - 4 767	7 40 40
7	2 39 42.84 166.58	14 14 06.1 801.6	3.07	5.78	.522 816 4 778	7 39 30
8	2 42 29.42 166.58	14 27 27.7 792.7	3.08	5.80	.518 038 4 790	7 38 20
9	2 45 16.00 166.59	14 40 40.4 783.7	3.09	5.82	.513 248 4 804	7 37 10
10	2 48 02.59 166.57	14 53 44.1 774.6	3.10	5.83	.508 444 4 817	7 36 00
11	2 50 49.16 +166.58	+15 06 38.7 ^s 15 19 24.2 ^s + 765.5	3.11	5.85	1.503 627 - 4 831	7 34 50
12	2 53 35.74 166.56	15 19 24.2 756.2	3.12	5.87	.498 796 4 847	7 33 40
13	2 56 22.30 166.54	15 32 00.4 746.8	3.13	5.89	.493 949 4 862	7 32 30
14	2 59 08.84 166.52	15 44 27.2 737.4	3.14	5.91	.489 087 4 879	7 31 20
15	3 01 55.36 166.49	15 56 44.6 727.8	3.15	5.93	.484 208 4 895	7 30 10
16	3 04 41.85 +166.45	+16 08 52.4 ^s 16 20 50.7 ^s + 718.3	3.16	5.95	1.479 313 - 4 913	7 29 00
17	3 07 28.30 166.41	16 20 50.7 708.5	3.17	5.97	.474 400 4 930	7 27 50
18	3 10 14.71 166.34	16 32 39.2 698.8	3.18	5.99	.469 470 4 949	7 26 40
19	3 13 01.05 166.28	16 44 18.0 688.9	3.20	6.01	.464 521 4 966	7 25 30
20	3 15 47.33 166.20	16 55 46.9 679.0	3.21	6.03	.459 555 4 985	7 24 20
21	3 18 33.53 +166.12	+17 07 05.9 ^s 17 18 14.9 ^s + 669.0	3.22	6.05	1.454 570 - 5 003	7 23 10
22	3 21 19.65 166.02	17 18 14.9 658.9	3.23	6.07	.449 567 5 022	7 21 59
23	3 24 05.67 165.91	17 29 13.8 648.8	3.24	6.09	.444 545 5 041	7 20 49
24	3 26 51.58 165.79	17 40 02.6 638.6	3.25	6.11	.439 504 5 059	7 19 38
25	3 29 37.37 165.66	17 50 41.2 628.3	3.26	6.13	.434 445 5 079	7 18 27
26	3 32 23.03 +165.53	+18 01 09.5 ^s 18 11 27.6 ^s + 618.1	3.27	6.16	1.429 366 - 5 097	7 17 16
27	3 35 08.56 165.38	18 11 27.6 607.7	3.29	6.18	.424 269 5 117	7 16 05
28	3 37 53.94 165.23	18 21 35.3 597.3	3.30	6.20	.419 152 5 135	7 14 54
29	3 40 39.17 165.06	18 31 32.6 586.8	3.31	6.22	.414 017 5 154	7 13 43
30	3 43 24.23 164.90	18 41 19.4 576.4	3.32	6.25	.408 863 5 173	7 12 31
31	3 46 09.13 +164.72	+18 50 55.8 ^s 19 00 21.8 ^s + 566.0	3.33	6.27	1.403 690 - 5 191	7 11 20
Aug. 1	3 48 53.85 164.53	19 00 21.8 555.4	3.35	6.29	.398 499 5 211	7 10 08
2	3 51 38.38 164.35	19 09 37.2 545.0	3.36	6.32	.393 288 5 230	7 08 56
3	3 54 22.73 164.14	19 18 42.2 534.4	3.37	6.34	.388 058 5 250	7 07 44
4	3 57 06.87 163.94	19 27 36.6 524.0	3.38	6.36	.382 808 5 269	7 06 31
5	3 59 50.81 +163.72	+19 36 20.6 ^s 19 44 54.0 ^s + 513.4	3.40	6.39	1.377 539 - 5 289	7 05 19
6	4 02 34.53 163.48	19 44 54.0 502.9	3.41	6.41	.372 250 5 310	7 04 06
7	4 05 18.01 163.25	19 53 16.9 492.4	3.42	6.44	.366 940 5 332	7 02 53
8	4 08 01.26 163.00	20 01 29.3 481.9	3.44	6.46	.361 608 5 353	7 01 39
9	4 10 44.26 162.73	20 09 31.2 471.4	3.45	6.49	.356 255 5 376	7 00 26
10	4 13 26.99 +162.46	+20 17 22.6 ^s 20 25 03.4 ^s + 460.8	3.46	6.51	1.350 879 - 5 399	6 59 12
11	4 16 09.45 162.17	20 25 03.4 450.3	3.48	6.54	.345 480 5 423	6 57 58
12	4 18 51.62 161.86	20 32 33.7 439.8	3.49	6.57	.340 057 5 447	6 56 43
13	4 21 33.48 161.53	20 39 53.5 429.4	3.51	6.59	.334 610 5 471	6 55 29
14	4 24 15.01 161.20	20 47 02.9 419.0	3.52	6.62	.329 139 5 495	6 54 14
15	4 26 56.21 +160.84	+20 54 01.9 ^s + 408.5	3.54	6.65	1.323 644 - 5 521	6 52 58
16	4 29 37.05	+21 00 50.4	3.55	6.68	1.318 123	6 51 43

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	4 29 37.05	+21 00 50.4	3.55	6.68	1.318 123	6 51 43
17	4 32 17.50	21 07 28.6	3.57	6.70	312 578	6 50 26
18	4 34 57.56	21 13 56.4	3.58	6.73	307 007	6 49 10
19	4 37 37.21	21 20 13.9	3.60	6.76	301 412	6 47 53
20	4 40 16.42	21 26 21.1	3.61	6.79	295 792	6 46 35
21	4 42 55.18	+21 32 18.1	3.63	6.82	1.290 147	6 45 18
22	4 45 33.47	21 38 04.9	3.64	6.85	284 477	6 43 59
23	4 48 11.26	21 43 41.5	3.66	6.88	278 782	6 42 41
24	4 50 48.55	21 49 08.1	3.68	6.91	273 063	6 41 21
25	4 53 25.32	21 54 24.6	3.69	6.94	267 320	6 40 01
26	4 56 01.54	+21 59 31.2	3.71	6.98	1.261 553	6 38 41
27	4 58 37.20	22 04 27.9	3.73	7.01	255 763	6 37 20
28	5 01 12.29	22 09 14.8	3.74	7.04	249 948	6 35 58
29	5 03 46.80	22 13 52.1	3.76	7.07	244 111	6 34 36
30	5 06 20.70	22 18 19.7	3.78	7.11	238 251	6 33 14
31	5 08 53.99	+22 22 37.8	3.80	7.14	1.232 367	6 31 50
Sept. 1	5 11 26.64	22 26 46.6	3.82	7.18	226 461	6 30 26
2	5 13 58.65	22 30 46.1	3.83	7.21	220 532	6 29 02
3	5 16 29.98	22 34 36.4	3.85	7.25	214 581	6 27 36
4	5 19 00.64	22 38 17.7	3.87	7.28	208 606	6 26 10
5	5 21 30.59	+22 41 50.0	3.89	7.32	1.202 608	6 24 43
6	5 23 59.83	22 45 13.5	3.91	7.35	196 585	6 23 16
7	5 26 28.33	22 48 28.3	3.93	7.39	190 540	6 21 48
8	5 28 56.08	22 51 34.5	3.95	7.43	184 470	6 20 19
9	5 31 23.06	22 54 32.3	3.97	7.47	178 375	6 18 49
10	5 33 49.23	+22 57 21.8	3.99	7.51	1.172 256	6 17 19
11	5 36 14.57	23 00 03.2	4.01	7.55	166 113	6 15 48
12	5 38 39.07	23 02 36.7	4.03	7.59	159 945	6 14 15
13	5 41 02.69	23 05 02.2	4.06	7.63	153 753	6 12 42
14	5 43 25.41	23 07 20.1	4.08	7.67	147 536	6 11 08
15	5 45 47.20	+23 09 30.5	4.10	7.71	1.141 296	6 09 33
16	5 48 08.03	23 11 33.6	4.12	7.75	135 032	6 07 58
17	5 50 27.88	23 13 29.5	4.15	7.80	128 746	6 06 21
18	5 52 46.72	23 15 18.3	4.17	7.84	122 436	6 04 43
19	5 55 04.51	23 17 00.4	4.19	7.88	116 105	6 03 04
20	5 57 21.25	+23 18 35.7	4.22	7.93	1.109 752	6 01 24
21	5 59 36.89	23 20 04.6	4.24	7.98	103 377	5 59 43
22	6 01 51.42	23 21 27.2	4.27	8.02	096 983	5 58 01
23	6 04 04.80	23 22 43.7	4.29	8.07	090 570	5 56 17
24	6 06 17.02	23 23 54.2	4.32	8.12	084 137	5 54 33
25	6 08 28.05	+23 24 59.1	4.34	8.17	1.077 687	5 52 47
26	6 10 37.87	23 25 58.5	4.37	8.21	071 220	5 51 00
27	6 12 46.45	23 26 52.7	4.40	8.26	064 737	5 49 12
28	6 14 53.77	23 27 41.8	4.42	8.32	058 238	5 47 23
29	6 16 59.81	23 28 26.1	4.45	8.37	051 724	5 45 32
30	6 19 04.54	+23 29 05.7	4.48	8.42	1.045 195	5 43 40
Oct. 1	6 21 07.94	23 29 41.1	4.51	8.47	1.038 653	5 41 47

MARS, 1960

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct. 1	6 21 07.94 ^s +122.03	+23 29 41.1 ["] + 31.2	4.51	8.47	1.038 653	5 41 47
2	6 23 09.97 120.66	23 30 12.3 27.3	4.53	8.53	.032 097	5 39 52
3	6 25 10.63 119.24	23 30 39.6 23.6	4.56	8.58	.025 528	5 37 56
4	6 27 09.87 117.80	23 31 03.2 20.2	4.59	8.64	.018 946	5 35 58
5	6 29 07.67 116.34	23 31 23.4 17.1	4.62	8.69	.012 353	5 34 00
6	6 31 04.01 +114.84	+23 31 40.5 + 14.2	4.65	8.75	1.005 747	5 31 59
7	6 32 58.85 113.30	23 31 54.7 11.5	4.68	8.81	0.999 130	5 29 57
8	6 34 52.15 111.73	23 32 06.2 9.2	4.72	8.87	.992 502	5 27 54
9	6 36 43.88 110.13	23 32 15.4 7.0	4.75	8.93	.985 864	5 25 49
10	6 38 34.01 108.48	23 32 22.4 5.3	4.78	8.99	.979 216	5 23 42
11	6 40 22.49 +106.78	+23 32 27.7 + 3.8	4.81	9.05	0.972 560	5 21 34
12	6 42 09.27 105.07	23 32 31.5 2.5	4.85	9.11	.965 897	5 19 24
13	6 43 54.34 103.29	23 32 34.0 1.5	4.88	9.17	.959 227	5 17 12
14	6 45 37.63 101.48	23 32 35.5 0.9	4.91	9.24	.952 552	5 14 59
15	6 47 19.11 99.62	23 32 36.4 0.4	4.95	9.30	.945 873	5 12 44
16	6 48 58.73 + 97.74	+23 32 36.8 + 0.2	4.98	9.37	0.939 191	5 10 27
17	6 50 36.47 95.79	23 32 37.0 0.5	5.02	9.44	.932 508	5 08 08
18	6 52 12.26 93.82	23 32 37.5 0.9	5.05	9.51	.925 824	5 05 47
19	6 53 46.08 91.79	23 32 38.4 1.6	5.09	9.57	.919 143	5 03 24
20	6 55 17.87 89.73	23 32 40.0 2.6	5.13	9.64	.912 465	5 00 59
21	6 56 47.60 + 87.62	+23 32 42.6 + 4.0	5.17	9.72	0.905 792	4 58 32
22	6 58 15.22 85.48	23 32 46.6 5.5	5.21	9.79	.899 127	4 56 03
23	6 59 40.70 83.29	23 32 52.1 7.5	5.24	9.86	.892 470	4 53 31
24	7 01 03.99 81.07	23 32 59.6 9.6	5.28	9.93	.885 825	4 50 58
25	7 02 25.06 78.80	23 33 09.2 12.1	5.32	10.01	.879 193	4 48 22
26	7 03 43.86 + 76.50	+23 33 21.3 + 15.0	5.36	10.09	0.872 576	4 45 44
27	7 05 00.36 74.14	23 33 36.3 18.0	5.40	10.16	.865 975	4 43 04
28	7 06 14.50 71.76	23 33 54.3 21.4	5.45	10.24	.859 392	4 40 21
29	7 07 26.26 69.32	23 34 15.7 25.0	5.49	10.32	.852 830	4 37 37
30	7 08 35.58 66.85	23 34 40.7 29.0	5.53	10.40	.846 290	4 34 49
31	7 09 42.43 + 64.33	+23 35 09.7 + 33.2	5.57	10.48	0.839 773	4 31 59
Nov. 1	7 10 46.76 61.76	23 35 42.9 37.6	5.62	10.56	.833 282	4 29 07
2	7 11 48.52 59.14	23 36 20.5 42.5	5.66	10.64	.826 818	4 26 12
3	7 12 47.66 56.48	23 37 03.0 47.5	5.70	10.73	.820 384	4 23 15
4	7 13 44.14 53.75	23 37 50.5 53.0	5.75	10.81	.813 981	4 20 14
5	7 14 37.89 + 50.98	+23 38 43.5 + 58.6	5.79	10.90	0.807 610	4 17 11
6	7 15 28.87 48.14	23 39 42.1 64.4	5.84	10.98	.801 276	4 14 06
7	7 16 17.01 45.24	23 40 46.5 70.7	5.89	11.07	.794 979	4 10 57
8	7 17 02.25 42.29	23 41 57.2 77.1	5.93	11.16	.788 723	4 07 46
9	7 17 44.54 39.28	23 43 14.3 83.8	5.98	11.25	.782 509	4 04 31
10	7 18 23.82 + 36.20	+23 44 38.1 + 90.6	6.03	11.34	0.776 342	4 01 14
11	7 19 00.02 33.08	23 46 08.7 97.8	6.08	11.43	.770 223	3 57 54
12	7 19 33.10 29.88	23 47 46.5 105.0	6.12	11.52	.764 156	3 54 30
13	7 20 02.98 26.64	23 49 31.5 112.5	6.17	11.61	.758 144	3 51 04
14	7 20 29.62 23.34	23 51 24.0 120.1	6.22	11.70	.752 191	3 47 34
15	7 20 52.96 + 19.98	+23 53 24.1 + 127.8	6.27	11.79	0.746 299	3 44 00
16	7 21 12.94	+23 55 31.9	6.32	11.88	0.740 472	3 40 24

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	7 21 12.94 + 16.58	+23 55 31.9	6.32	11.88	0.740 472 - 5 757	3 40 24
17	7 21 29.52 13.12	23 57 47.6	6.37	11.98	.734 715 5 685	3 36 44
18	7 21 42.64 9.62	24 00 11.2	6.42	12.07	.729 030 5 608	3 33 01
19	7 21 52.26 6.08	24 02 42.9	6.47	12.16	.723 422 5 526	3 29 14
20	7 21 58.34 + 2.50	24 05 22.6	6.52	12.26	.717 896 5 442	3 25 23
21	7 22 00.84 - 1.11	+24 08 10.4	6.57	12.35	0.712 454 - 5 352	3 21 29
22	7 21 59.73 + 7.5	24 11 06.2	6.62	12.45	.707 102 5 259	3 17 32
23	7 21 54.98 8.42	24 14 10.1	6.67	12.54	.701 843 5 163	3 13 31
24	7 21 46.56 12.10	24 17 21.8	6.72	12.63	.696 680 5 061	3 09 26
25	7 21 34.46 15.82	24 20 41.5	6.77	12.72	.691 619 4 956	3 05 18
26	7 21 18.64 - 19.54	+24 24 08.8	6.82	12.82	0.686 663 - 4 848	3 01 05
27	7 20 59.10 23.26	24 27 43.6	6.86	12.91	.681 815 4 735	2 56 50
28	7 20 35.84 27.01	24 31 25.8	6.91	13.00	.677 080 4 619	2 52 30
29	7 20 08.83 30.75	24 35 15.1	6.96	13.09	.672 461 4 498	2 48 07
30	7 19 38.08 34.49	24 39 11.3	7.01	13.17	.667 963 4 375	2 43 40
Dec. 1	7 19 03.59 - 38.24	+24 43 14.0	7.05	13.26	0.663 588 - 4 245	2 39 09
2	7 18 25.35 41.96	24 47 22.9	7.10	13.35	.659 343 4 114	2 34 35
3	7 17 43.39 45.69	24 51 37.9	7.14	13.43	.655 229 3 976	2 29 57
4	7 16 57.70 49.38	24 55 58.3	7.19	13.51	.651 253 3 836	2 25 15
5	7 16 08.32 53.06	25 00 23.7	7.23	13.59	.647 417 3 690	2 20 30
6	7 15 15.26 - 56.69	+25 04 53.8	7.27	13.67	0.643 727 - 3 541	2 15 41
7	7 14 18.57 60.27	25 09 28.0	7.31	13.75	.640 186 3 387	2 10 48
8	7 13 18.30 63.82	25 14 05.7	7.35	13.82	.636 799 3 229	2 05 52
9	7 12 14.48 67.28	25 18 46.4	7.39	13.89	.633 570 3 066	2 00 53
10	7 11 07.20 70.67	25 23 29.4	7.42	13.96	.630 504 2 898	1 55 50
11	7 09 56.53 - 73.98	+25 28 14.0	7.46	14.02	0.627 606 - 2 727	1 50 43
12	7 08 42.55 77.18	25 32 59.7	7.49	14.08	.624 879 2 551	1 45 34
13	7 07 25.37 80.29	25 37 45.6	7.52	14.14	.622 328 2 372	1 40 21
14	7 06 05.08 83.25	25 42 31.1	7.55	14.19	.619 956 2 186	1 35 05
15	7 04 41.83 86.10	25 47 15.4	7.58	14.24	.617 770 1 998	1 29 46
16	7 03 15.73 - 88.78	+25 51 57.8	7.60	14.29	0.615 772 - 1 806	1 24 24
17	7 01 46.95 91.31	25 56 37.5	7.62	14.33	.613 966 1 609	1 19 00
18	7 00 15.64 93.65	26 01 13.7	7.64	14.37	.612 357 1 410	1 13 33
19	6 58 41.99 95.84	26 05 45.8	7.66	14.40	.610 947 1 207	1 08 04
20	6 57 06.15 97.79	26 10 12.9	7.68	14.43	.609 740 1 002	1 02 33
21	6 55 28.36 - 99.57	+26 14 34.4	7.69	14.46	0.608 738 - 794	0 57 00
22	6 53 48.79 101.13	26 18 49.7	7.70	14.48	.607 944 583	0 51 25
23	6 52 07.66 102.48	26 22 57.9	7.71	14.49	.607 361 372	0 45 49
24	6 50 25.18 103.61	26 26 58.5	7.71	14.50	.606 989 - 158	0 40 11
25	6 48 41.57 104.51	26 30 51.0	7.71	14.50	.606 831 + 56	0 34 32
26	6 46 57.06 - 105.20	+26 34 34.9	7.71	14.50	0.606 887 + 271	0 28 52
27	6 45 11.86 105.67	26 38 09.6	7.71	14.49	.607 158 487	0 23 12
28	6 43 26.19 105.89	26 41 34.8	7.70	14.48	.607 645 703	0 17 31
29	6 41 40.30 105.93	26 44 50.1	7.69	14.47	.608 348 920	0 11 50
30	6 39 54.37 105.72	26 47 55.3	7.68	14.44	.609 268 1 137	0 06 09
31	6 38 08.65 - 105.31	+26 50 49.9	7.67	14.42	0.610 405 + 1 354	{ 0 00 28 } { 23 54 47 }
32	6 36 23.34	+26 53 33.9	7.65	14.38	0.611 759	23 49 07

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Date	Apparent Right Ascension			Apparent Declination			Polar S.D.	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Jan.	0	17 10 14.820	+56.640	-22 28 23.47	-	70.46	14.76	1.41	6.227 324	-	5 973	10 34 14
	1	17 11 11.460	56.503	22 29 33.93		68.98	14.77	1.41	.221 351		6 179	10 31 14
	2	17 12 07.963	56.357	22 30 42.91		67.50	14.79	1.42	.215 172		6 386	10 28 14
	3	17 13 04.320	56.208	22 31 50.41		66.01	14.80	1.42	.208 786		6 589	10 25 15
	4	17 14 00.528	56.052	22 32 56.42		64.52	14.82	1.42	.202 197		6 793	10 22 15
	5	17 14 56.580	+55.891	-22 34 00.94	-	63.04	14.84	1.42	6.195 404	-	6 994	10 19 14
	6	17 15 52.471	55.726	22 35 03.98		61.57	14.85	1.42	.188 410		7 193	10 16 14
	7	17 16 48.197	55.553	22 36 05.55		60.10	14.87	1.42	.181 217		7 393	10 13 13
	8	17 17 43.750	55.376	22 37 05.65		58.64	14.89	1.43	.173 824		7 590	10 10 13
	9	17 18 39.126	55.191	22 38 04.29		57.21	14.91	1.43	.166 234		7 786	10 07 12
	10	17 19 34.317	+55.001	-22 39 01.50	-	55.77	14.92	1.43	6.158 448	-	7 980	10 04 11
	11	17 20 29.318	54.803	22 39 57.27		54.34	14.94	1.43	.150 468		8 173	10 01 10
	12	17 21 24.121	54.599	22 40 51.61		52.93	14.96	1.43	.142 295		8 365	9 58 08
	13	17 22 18.720	54.387	22 41 44.54		51.51	14.98	1.43	.133 930		8 556	9 55 06
	14	17 23 13.107	54.170	22 42 36.05		50.11	15.00	1.44	.125 374		8 744	9 52 05
	15	17 24 07.277	+53.945	-22 43 26.16	-	48.72	15.03	1.44	6.116 630	-	8 932	9 49 02
	16	17 25 01.222	53.714	22 44 14.88		47.32	15.05	1.44	.107 698		9 119	9 46 00
	17	17 25 54.936	53.476	22 45 02.20		45.93	15.07	1.44	.098 579		9 304	9 42 58
	18	17 26 48.412	53.231	22 45 48.13		44.55	15.09	1.45	.089 275		9 487	9 39 55
	19	17 27 41.643	52.983	22 46 32.68		43.18	15.12	1.45	.079 788		9 671	9 36 52
	20	17 28 34.626	+52.727	-22 47 15.86	-	41.83	15.14	1.45	6.070 117	-	9 851	9 33 48
	21	17 29 27.353	52.465	22 47 57.69		40.48	15.17	1.45	.060 266		10 031	9 30 45
	22	17 30 19.818	52.197	22 48 38.17		39.15	15.19	1.45	.050 235		10 210	9 27 41
	23	17 31 12.015	51.921	22 49 17.32		37.86	15.22	1.46	.040 025		10 386	9 24 37
	24	17 32 03.936	51.637	22 49 55.18		36.57	15.24	1.46	.029 639		10 562	9 21 33
	25	17 32 55.573	+51.343	-22 50 31.75	-	35.31	15.27	1.46	6.019 077	-	10 735	9 18 28
	26	17 33 46.916	51.040	22 51 07.06		34.07	15.30	1.46	.008 342		10 907	9 15 23
	27	17 34 37.956	50.726	22 51 41.13		32.83	15.32	1.47	.997 435		11 077	9 12 18
	28	17 35 28.682	50.403	22 52 13.96		31.59	15.35	1.47	.986 358		11 244	9 09 12
	29	17 36 19.085	50.072	22 52 45.55		30.37	15.38	1.47	.975 114		11 408	9 06 06
	30	17 37 09.157	+49.735	-22 53 15.92	-	29.15	15.41	1.48	5.963 706	-	11 571	9 03 00
Feb.	31	17 37 58.892	49.389	22 53 45.07		27.93	15.44	1.48	.952 135		11 731	8 59 54
	1	17 38 48.281	49.041	22 54 13.00		26.75	15.47	1.48	.940 404		11 888	8 56 47
	2	17 39 37.322	48.684	22 54 39.75		25.58	15.50	1.48	.928 516		12 043	8 53 40
	3	17 40 26.006	48.321	22 55 05.33		24.43	15.53	1.49	.916 473		12 195	8 50 32
	4	17 41 14.327	+47.953	-22 55 29.76	-	23.31	15.57	1.49	5.904 278	-	12 345	8 47 24
	5	17 42 02.280	47.577	22 55 53.07		22.20	15.60	1.49	.891 933		12 493	8 44 16
	6	17 42 49.857	47.195	22 56 15.27		21.12	15.63	1.50	.879 440		12 637	8 41 07
	7	17 43 37.052	46.805	22 56 36.39		20.06	15.67	1.50	.866 803		12 779	8 37 58
	8	17 44 23.857	46.408	22 56 56.45		19.03	15.70	1.50	.854 024		12 920	8 34 48
	9	17 45 10.265	+46.003	-22 57 15.48	-	18.01	15.74	1.51	5.841 104	-	13 057	8 31 39
	10	17 45 56.268	45.592	22 57 33.49		17.02	15.77	1.51	.828 047		13 192	8 28 28
	11	17 46 41.860	45.172	22 57 50.51		16.04	15.81	1.51	.814 855		13 325	8 25 18
	12	17 47 27.032	44.746	22 58 06.55		15.08	15.84	1.52	.801 530		13 455	8 22 06
	13	17 48 11.778	44.314	22 58 21.63		14.13	15.88	1.52	.788 075		13 583	8 18 55
	14	17 48 56.092	+43.873	-22 58 35.76	-	13.20	15.92	1.52	5.774 492	-	13 708	8 15 43
	15	17 49 39.965		-22 58 48.96			15.95	1.53	5.760 784			8 12 31

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]				^h ^m ^s
Feb. 15	17 49 39.965	-22 58 48.96	15.95	1.53	5.760 784	8 12 31
16	17 50 23.393	22 59 01.26	15.99	1.53	5.746 952	8 09 18
17	17 51 06.369	22 59 12.68	16.03	1.53	5.733 000	8 06 04
18	17 51 48.886	22 59 23.24	16.07	1.54	5.718 929	8 02 51
19	17 52 30.937	22 59 32.96	16.11	1.54	5.704 742	7 59 36
20	17 53 12.516	-22 59 41.88	16.15	1.55	5.690 441	7 56 22
21	17 53 53.613	22 59 50.04	16.19	1.55	5.676 029	7 53 07
22	17 54 34.218	22 59 57.47	16.23	1.55	5.661 510	7 49 51
23	17 55 14.323	23 00 04.18	16.28	1.56	5.646 885	7 46 35
24	17 55 53.917	23 00 10.21	16.32	1.56	5.632 157	7 43 18
25	17 56 32.990	-23 00 15.57	16.36	1.57	5.617 331	7 40 01
26	17 57 11.532	23 00 20.27	16.41	1.57	5.602 409	7 36 43
27	17 57 49.536	23 00 24.34	16.45	1.57	5.587 394	7 33 25
28	17 58 26.995	23 00 27.78	16.49	1.58	5.572 291	7 30 06
29	17 59 03.903	23 00 30.62	16.54	1.58	5.557 103	7 26 47
Mar. 1	17 59 40.253	-23 00 32.89	16.58	1.59	5.541 832	7 23 27
2	18 00 16.040	23 00 34.62	16.63	1.59	5.526 484	7 20 06
3	18 00 51.256	23 00 35.82	16.68	1.60	5.511 061	7 16 45
4	18 01 25.895	23 00 36.54	16.72	1.60	5.495 567	7 13 24
5	18 01 59.951	23 00 36.80	16.77	1.61	5.480 005	7 10 01
6	18 02 33.416	-23 00 36.63	16.82	1.61	5.464 379	7 06 39
7	18 03 06.283	23 00 36.06	16.87	1.62	5.448 692	7 03 15
8	18 03 38.544	23 00 35.11	16.92	1.62	5.432 949	6 59 51
9	18 04 10.193	23 00 33.81	16.97	1.62	5.417 151	6 56 27
10	18 04 41.223	23 00 32.18	17.02	1.63	5.401 304	6 53 02
11	18 05 11.626	-23 00 30.24	17.07	1.63	5.385 409	6 49 36
12	18 05 41.396	23 00 28.01	17.12	1.64	5.369 471	6 46 09
13	18 06 10.527	23 00 25.52	17.17	1.64	5.353 493	6 42 42
14	18 06 39.014	23 00 22.78	17.22	1.65	5.337 477	6 39 14
15	18 07 06.852	23 00 19.81	17.27	1.65	5.321 428	6 35 46
16	18 07 34.033	-23 00 16.64	17.32	1.66	5.305 349	6 32 17
17	18 08 00.552	23 00 13.30	17.38	1.66	5.289 243	6 28 47
18	18 08 26.402	23 00 09.82	17.43	1.67	5.273 112	6 25 17
19	18 08 51.577	23 00 06.24	17.48	1.67	5.256 962	6 21 46
20	18 09 16.066	23 00 02.59	17.54	1.68	5.240 796	6 18 14
21	18 09 39.862	-22 59 58.89	17.59	1.68	5.224 616	6 14 42
22	18 10 02.955	22 59 55.16	17.65	1.69	5.208 428	6 11 09
23	18 10 25.336	22 59 51.44	17.70	1.69	5.192 235	6 07 35
24	18 10 46.998	22 59 47.71	17.76	1.70	5.176 041	6 04 00
25	18 11 07.933	22 59 44.01	17.81	1.71	5.159 850	6 00 25
26	18 11 28.135	-22 59 40.35	17.87	1.71	5.143 668	5 56 49
27	18 11 47.600	22 59 36.73	17.92	1.72	5.127 498	5 53 12
28	18 12 06.322	22 59 33.18	17.98	1.72	5.111 344	5 49 35
29	18 12 24.297	22 59 29.72	18.04	1.73	5.095 212	5 45 57
30	18 12 41.521	22 59 26.37	18.10	1.73	5.079 105	5 42 18
31	18 12 57.989	-22 59 23.15	18.15	1.74	5.063 028	5 38 38
Apr. 1	18 13 13.697	22 59 20.09	18.21	1.74	5.046 986	5 34 57

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["]		^h ^m ^s
Apr. 1	18 13 13.697 ^s	-22 59 20.09 ⁺	18.21	1.74	5.046 986	5 34 57
2	18 13 28.640 ^{+14.943}	22 59 17.21 ^{2.88}	18.27	1.75	.030 982	5 31 16
3	18 13 42.812 ^{14.172}	22 59 14.52 ^{2.69}	18.33	1.75	5.015 021	5 27 34
4	18 13 56.210 ^{13.398}	22 59 12.05 ^{2.47}	18.39	1.76	4.999 107	5 23 51
5	18 14 08.830 ^{12.620}	22 59 09.80 ^{2.25}	18.44	1.77	.983 245	5 20 08
6	18 14 20.666 ^{11.836}	-22 59 07.80 ^{2.00}	18.50	1.77	4.967 438	5 16 24
7	18 14 31.716 ^{+11.050}	22 59 06.05 ⁺	18.56	1.78	.951 691	5 12 39
8	18 14 41.976 ^{10.260}	22 59 04.55 ^{1.50}	18.62	1.78	.936 008	5 08 53
9	18 14 51.444 ^{9.468}	22 59 03.33 ^{1.22}	18.68	1.79	.920 392	5 05 06
10	18 15 00.117 ^{8.673}	22 59 02.39 ^{0.94}	18.74	1.79	.904 849	5 01 19
11	18 15 07.992 ^{7.875}	-22 59 01.72 ^{0.67}	18.80	1.80	4.889 381	4 57 30
12	18 15 15.070 ^{+7.078}	22 59 01.35 ⁺	18.86	1.81	.873 993	4 53 41
13	18 15 21.348 ^{6.278}	22 59 01.29 ^{0.06}	18.92	1.81	.858 689	4 49 52
14	18 15 26.825 ^{5.477}	22 59 01.55 ⁻	18.98	1.82	.843 473	4 46 01
15	18 15 31.496 ^{4.671}	22 59 02.16 ^{0.61}	19.04	1.82	.828 348	4 42 09
16	18 15 35.359 ^{3.863}	-22 59 03.12 ^{0.96}	19.09	1.83	4.813 319	4 38 17
17	18 15 38.408 ^{+3.049}	22 59 04.45 ⁻	19.15	1.83	.798 390	4 34 24
18	18 15 40.641 ^{2.233}	22 59 06.17 ^{1.72}	19.21	1.84	.783 566	4 30 30
19	18 15 42.052 ^{1.411}	22 59 08.27 ^{2.10}	19.27	1.85	.768 850	4 26 36
20	18 15 42.640 ^{+0.588}	22 59 10.74 ^{2.47}	19.33	1.85	.754 248	4 22 40
21	18 15 42.402 ^{-0.238}	-22 59 13.57 ^{2.83}	19.39	1.86	4.739 764	4 18 44
22	18 15 41.339 ^{-1.063}	22 59 16.77 ⁻	19.45	1.86	.725 403	4 14 47
23	18 15 39.452 ^{1.887}	22 59 20.32 ^{3.20}	19.51	1.87	.711 170	4 10 49
24	18 15 36.741 ^{1.887}	22 59 24.22 ^{3.55}	19.57	1.87	.697 069	4 06 50
25	18 15 33.211 ^{2.711}	22 59 28.48 ^{3.90}	19.63	1.88	.683 105	4 02 51
26	18 15 28.861 ^{3.530}	-22 59 33.09 ^{4.26}	19.68	1.88	4.669 283	3 58 50
27	18 15 23.697 ^{-5.164}	22 59 38.05 ⁻	19.74	1.89	.655 608	3 54 49
28	18 15 17.720 ^{5.977}	22 59 43.35 ^{4.96}	19.80	1.90	.642 083	3 50 47
29	18 15 10.935 ^{6.785}	22 59 49.02 ^{5.30}	19.86	1.90	.628 715	3 46 44
30	18 15 03.343 ^{7.592}	22 59 55.03 ^{6.01}	19.91	1.91	.615 506	3 42 41
May 1	18 14 54.949 ^{8.394}	-23 00 01.38 ^{6.35}	19.97	1.91	4.602 462	3 38 36
2	18 14 45.758 ^{-9.191}	23 00 08.06 ⁻	20.03	1.92	.589 586	3 34 31
3	18 14 35.773 ^{9.985}	23 00 15.07 ^{7.01}	20.08	1.92	.576 883	3 30 25
4	18 14 25.000 ^{10.773}	23 00 22.39 ^{7.32}	20.14	1.93	.564 358	3 26 18
5	18 14 13.445 ^{11.555}	23 00 30.00 ^{7.61}	20.19	1.93	.552 013	3 22 11
6	18 14 01.116 ^{12.329}	-23 00 37.90 ^{7.90}	20.25	1.94	4.539 853	3 18 03
7	18 13 48.018 ^{-13.098}	23 00 46.06 ⁻	20.30	1.94	.527 883	3 13 54
8	18 13 34.160 ^{13.858}	23 00 54.47 ^{8.16}	20.35	1.95	.516 105	3 09 44
9	18 13 19.551 ^{14.609}	23 01 03.11 ^{8.41}	20.40	1.95	.504 523	3 05 33
10	18 13 04.201 ^{15.350}	23 01 11.97 ^{8.86}	20.46	1.96	.493 141	3 01 22
11	18 12 48.118 ^{16.083}	-23 01 21.05 ^{9.08}	20.51	1.96	4.481 963	2 57 10
12	18 12 31.311 ^{-16.807}	23 01 30.33 ⁻	20.56	1.97	.470 991	2 52 57
13	18 12 13.787 ^{17.524}	23 01 39.82 ^{9.49}	20.61	1.97	.460 230	2 48 44
14	18 11 55.553 ^{18.234}	23 01 49.50 ^{9.68}	20.66	1.98	.449 683	2 44 30
15	18 11 36.616 ^{18.937}	23 01 59.36 ^{9.86}	20.70	1.98	.439 354	2 40 15
16	18 11 16.984 ^{19.632}	-23 02 09.39 ^{10.03}	20.75	1.99	4.429 247	2 36 00
17	18 10 56.665 ^{-20.319}	-23 02 19.55 ⁻	20.80	1.99	4.419 365	2 31 43

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["] ["]		^h ^m ^s
May 17	18 10 56.665	-23 02 19.55	20.80	1.99	4.419 365	2 31 43
18	18 10 35.670	23 02 29.81	20.84	2.00	.409 712	2 27 26
19	18 10 14.012	23 02 40.15	20.89	2.00	.400 292	2 23 09
20	18 09 51.702	23 02 50.55	20.93	2.00	.391 110	2 18 51
21	18 09 28.757	23 03 00.97	20.97	2.01	.382 168	2 14 32
22	18 09 05.190	-23 03 11.40	21.02	2.01	4.373 471	2 10 13
23	18 08 41.017	23 03 21.82	21.06	2.02	.365 022	2 05 53
24	18 08 16.255	23 03 32.22	21.10	2.02	.356 824	2 01 32
25	18 07 50.920	23 03 42.58	21.13	2.02	.348 880	1 57 11
26	18 07 25.029	23 03 52.88	21.17	2.03	.341 195	1 52 49
27	18 06 58.596	-23 04 03.11	21.21	2.03	4.333 771	1 48 27
28	18 06 31.642	23 04 13.24	21.24	2.03	.326 611	1 44 04
29	18 06 04.183	23 04 23.27	21.28	2.04	.319 717	1 39 41
30	18 05 36.238	23 04 33.17	21.31	2.04	.313 093	1 35 17
31	18 05 07.825	23 04 42.92	21.34	2.04	.306 740	1 30 53
June 1	18 04 38.963	-23 04 52.50	21.37	2.05	4.300 661	1 26 28
2	18 04 09.673	23 05 01.88	21.40	2.05	.294 858	1 22 03
3	18 03 39.975	23 05 11.05	21.43	2.05	.289 333	1 17 38
4	18 03 09.891	23 05 20.00	21.45	2.05	.284 087	1 13 12
5	18 02 39.441	23 05 28.69	21.48	2.06	.279 123	1 08 46
6	18 02 08.649	-23 05 37.12	21.50	2.06	4.274 442	1 04 19
7	18 01 37.535	23 05 45.27	21.52	2.06	.270 044	0 59 53
8	18 01 06.123	23 05 53.15	21.55	2.06	.265 933	0 55 25
9	18 00 34.433	23 06 00.75	21.56	2.06	.262 107	0 50 58
10	18 00 02.483	23 06 08.06	21.58	2.07	.258 570	0 46 30
11	17 59 30.293	-23 06 15.10	21.60	2.07	4.255 321	0 42 02
12	17 58 57.881	23 06 21.84	21.61	2.07	.252 363	0 37 34
13	17 58 25.268	23 06 28.25	21.63	2.07	.249 695	0 33 06
14	17 57 52.473	23 06 34.35	21.64	2.07	.247 321	0 28 37
15	17 57 19.519	23 06 40.10	21.65	2.07	.245 240	0 24 09
16	17 56 46.430	-23 06 45.48	21.66	2.07	4.243 454	0 19 40
17	17 56 13.232	23 06 50.49	21.67	2.07	.241 964	0 15 11
18	17 55 39.946	23 06 55.13	21.67	2.08	.240 770	0 10 42
19	17 55 06.599	23 06 59.39	21.68	2.08	.239 873	0 06 13
20	17 54 33.217	23 07 03.28	21.68	2.08	.239 275	{ 0 01 44 } { 23 57 15 }
21	17 53 59.823	-23 07 06.80	21.68	2.08	4.238 974	23 52 46
22	17 53 26.444	23 07 09.96	21.68	2.08	.238 971	23 48 17
23	17 52 53.100	23 07 12.77	21.68	2.08	.239 266	23 43 48
24	17 52 19.818	23 07 15.23	21.68	2.08	.239 860	23 39 19
25	17 51 46.621	23 07 17.34	21.67	2.08	.240 750	23 34 50
26	17 51 13.534	-23 07 19.12	21.67	2.07	4.241 937	23 30 21
27	17 50 40.578	23 07 20.57	21.66	2.07	.243 420	23 25 53
28	17 50 07.780	23 07 21.70	21.65	2.07	.245 197	23 21 24
29	17 49 35.162	23 07 22.50	21.64	2.07	.247 268	23 16 56
30	17 49 02.747	23 07 23.00	21.63	2.07	.249 632	23 12 28
July 1	17 48 30.559	-23 07 23.20	21.61	2.07	4.252 286	23 08 01
2	17 47 58.623	-23 07 23.10	21.60	2.07	4.255 229	23 03 33

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	17 48 30.559 ^s -31.936	-23 07 23.20 [°] + 0.10	21.61	2.07	4.252 286 + 2 943	23 08 01
2	17 47 58.623 31.661	23 07 23.10 [°] + 0.37	21.60	2.07	.255 229 + 3 231	23 03 33
3	17 47 26.962 31.364	23 07 22.73 [°] + 0.63	21.58	2.07	.258 460 + 3 515	22 59 06
4	17 46 55.598 31.046	23 07 22.10 [°] + 0.86	21.57	2.06	.261 975 + 3 799	22 54 39
5	17 46 24.552 30.705	23 07 21.24 [°] + 1.07	21.55	2.06	.265 774 + 4 080	22 50 13
6	17 45 53.847 -30.347	-23 07 20.17 [°] + 1.26	21.53	2.06	4.269 854 + 4 359	22 45 47
7	17 45 23.500 29.969	23 07 18.91 [°] + 1.42	21.50	2.06	.274 213 + 4 636	22 41 21
8	17 44 53.531 29.577	23 07 17.49 [°] + 1.55	21.48	2.06	.278 849 + 4 910	22 36 56
9	17 44 23.954 29.167	23 07 15.94 [°] + 1.67	21.46	2.05	.283 759 + 5 183	22 32 31
10	17 43 54.787 28.741	23 07 14.27 [°] + 1.79	21.43	2.05	.288 942 + 5 452	22 28 06
11	17 43 26.046 -28.297	-23 07 12.48 [°] + 1.89	21.40	2.05	4.294 394 + 5 722	22 23 42
12	17 42 57.749 27.835	23 07 10.59 [°] + 2.00	21.37	2.05	.300 116 + 5 987	22 19 18
13	17 42 29.914 27.353	23 07 08.59 [°] + 2.08	21.34	2.04	.306 103 + 6 251	22 14 55
14	17 42 02.561 26.853	23 07 06.51 [°] + 2.15	21.31	2.04	.312 354 + 6 514	22 10 33
15	17 41 35.708 26.333	23 07 04.36 [°] + 2.18	21.28	2.04	.318 868 + 6 772	22 06 11
16	17 41 09.375 -25.795	-23 07 02.18 [°] + 2.20	21.25	2.03	4.325 640 + 7 029	22 01 49
17	17 40 43.580 25.239	23 06 59.98 [°] + 2.19	21.21	2.03	.332 669 + 7 283	21 57 28
18	17 40 18.341 24.668	23 06 57.79 [°] + 2.14	21.18	2.03	.339 952 + 7 534	21 53 07
19	17 39 53.673 24.080	23 06 55.65 [°] + 2.08	21.14	2.02	.347 486 + 7 782	21 48 48
20	17 39 29.593 23.477	23 06 53.57 [°] + 1.99	21.10	2.02	.355 268 + 8 026	21 44 28
21	17 39 06.116 -22.859	-23 06 51.58 [°] + 1.88	21.06	2.02	4.363 294 + 8 268	21 40 10
22	17 38 43.257 22.228	23 06 49.70 [°] + 1.73	21.02	2.01	.371 562 + 8 507	21 35 51
23	17 38 21.029 21.581	23 06 47.97 [°] + 1.59	20.98	2.01	.380 069 + 8 740	21 31 34
24	17 37 59.448 20.924	23 06 46.38 [°] + 1.40	20.94	2.01	.388 809 + 8 972	21 27 17
25	17 37 38.524 20.253	23 06 44.98 [°] + 1.22	20.90	2.00	.397 781 + 9 198	21 23 01
26	17 37 18.271 -19.569	-23 06 43.76 [°] + 1.01	20.86	2.00	4.406 979 + 9 422	21 18 46
27	17 36 58.702 18.873	23 06 42.75 [°] + 0.77	20.81	1.99	.416 401 + 9 641	21 14 31
28	17 36 39.829 18.166	23 06 41.98 [°] + 0.53	20.77	1.99	.426 042 + 9 856	21 10 17
29	17 36 21.663 17.447	23 06 41.45 [°] + 0.27	20.72	1.98	.435 898 + 10 067	21 06 04
30	17 36 04.216 16.718	23 06 41.18 [°] + 0.02	20.67	1.98	.445 965 + 10 273	21 01 51
31	17 35 47.498 -15.980	-23 06 41.20 [°] - 0.33	20.63	1.97	4.456 238 + 10 476	20 57 39
Aug. 1	17 35 31.518 15.233	23 06 41.53 [°] - 0.67	20.58	1.97	.466 714 + 10 675	20 53 28
2	17 35 16.285 14.479	23 06 42.20 [°] - 1.01	20.53	1.97	.477 389 + 10 868	20 49 18
3	17 35 01.806 13.720	23 06 43.21 [°] - 1.41	20.48	1.96	.488 257 + 11 058	20 45 08
4	17 34 48.086 12.956	23 06 44.62 [°] - 1.81	20.43	1.96	.499 315 + 11 243	20 40 59
5	17 34 35.130 -12.189	-23 06 46.43 [°] - 2.21	20.38	1.95	4.510 558 + 11 425	20 36 51
6	17 34 22.941 11.420	23 06 48.64 [°] - 2.64	20.33	1.95	.521 983 + 11 603	20 32 43
7	17 34 11.521 10.646	23 06 51.28 [°] - 3.04	20.27	1.94	.533 586 + 11 777	20 28 37
8	17 34 00.875 9.868	23 06 54.32 [°] - 3.46	20.22	1.94	.545 363 + 11 947	20 24 31
9	17 33 51.007 9.084	23 06 57.78 [°] - 3.88	20.17	1.93	.557 310 + 12 113	20 20 26
10	17 33 41.923 -8.294	-23 07 01.66 [°] - 4.30	20.11	1.93	4.569 423 + 12 276	20 16 22
11	17 33 33.629 7.498	23 07 05.96 [°] - 4.74	20.06	1.92	.581 699 + 12 435	20 12 18
12	17 33 26.131 6.697	23 07 10.70 [°] - 5.18	20.01	1.92	.594 134 + 12 589	20 08 15
13	17 33 19.434 5.893	23 07 15.88 [°] - 5.65	19.95	1.91	.606 723 + 12 741	20 04 14
14	17 33 13.541 5.085	23 07 21.53 [°] - 6.10	19.90	1.90	.619 464 + 12 887	20 00 12
15	17 33 08.456 -4.273	-23 07 27.63 [°] - 6.59	19.84	1.90	4.632 351 + 13 030	19 56 12
16	17 33 04.183	-23 07 34.22 [°] -	19.79	1.89	.645 381	19 52 13

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]				^h ^m ^s
Aug. 16	17 33 04.183 - 3.459	-23 07 34.22 - 7.08	19.79	1.89	4.645 381 +13 169	19 52 13
17	17 33 00.724 2.644	23 07 41.30 7.58	19.73	1.89	.658 550 13 302	19 48 14
18	17 32 58.080 1.827	23 07 48.88 8.07	19.67	1.88	.671 852 13 433	19 44 16
19	17 32 56.253 1.009	23 07 56.95 8.56	19.62	1.88	.685 285 13 557	19 40 19
20	17 32 55.244 - 0.191	23 08 05.51 9.06	19.56	1.87	.698 842 13 679	19 36 23
21	17 32 55.053 + 0.629	-23 08 14.57 - 9.56	19.50	1.87	4.712 521 +13 795	19 32 27
22	17 32 55.682 1.447	23 08 24.13 10.04	19.45	1.86	.726 316 13 907	19 28 33
23	17 32 57.129 2.267	23 08 34.17 10.52	19.39	1.86	.740 223 14 014	19 24 39
24	17 32 59.396 3.086	23 08 44.69 10.99	19.33	1.85	.754 237 14 117	19 20 46
25	17 33 02.482 3.906	23 08 55.68 11.46	19.27	1.85	.768 354 14 214	19 16 54
26	17 33 06.388 + 4.724	-23 09 07.14 - 11.93	19.22	1.84	4.782 568 +14 308	19 13 02
27	17 33 11.112 5.542	23 09 19.07 12.40	19.16	1.83	.796 876 14 397	19 09 12
28	17 33 16.654 6.357	23 09 31.47 12.86	19.10	1.83	.811 273 14 481	19 05 22
29	17 33 23.011 7.168	23 09 44.33 13.32	19.05	1.82	.825 754 14 560	19 01 33
30	17 33 30.179 7.977	23 09 57.65 13.80	18.99	1.82	.840 314 14 636	18 57 45
Sept. 31	17 33 38.156 + 8.778	-23 10 11.45 - 14.24	18.93	1.81	4.854 950 +14 707	18 53 58
1	17 33 46.934 9.576	23 10 25.69 14.68	18.87	1.81	.869 657 14 773	18 50 11
2	17 33 56.510 10.366	23 10 40.37 15.12	18.82	1.80	.884 430 14 836	18 46 25
3	17 34 06.876 11.151	23 10 55.49 15.52	18.76	1.80	.899 266 14 895	18 42 40
4	17 34 18.027 11.930	23 11 11.01 15.90	18.70	1.79	.914 161 14 950	18 38 56
5	17 34 29.957 +12.707	-23 11 26.91 - 16.25	18.65	1.79	4.929 111 +15 001	18 35 13
6	17 34 42.664 13.480	23 11 43.16 16.58	18.59	1.78	.944 112 15 049	18 31 30
7	17 34 56.144 14.251	23 11 59.74 16.91	18.53	1.77	.959 161 15 093	18 27 48
8	17 35 10.395 15.019	23 12 16.65 17.22	18.48	1.77	.974 254 15 133	18 24 07
9	17 35 25.414 15.784	23 12 33.87 17.51	18.42	1.76	4.989 387 15 170	18 20 27
10	17 35 41.198 +16.544	-23 12 51.38 - 17.79	18.37	1.76	5.004 557 +15 202	18 16 47
11	17 35 57.742 17.301	23 13 09.17 18.07	18.31	1.75	.019 759 15 231	18 13 08
12	17 36 15.043 18.054	23 13 27.24 18.33	18.25	1.75	.034 990 15 257	18 09 30
13	17 36 33.097 18.800	23 13 45.57 18.57	18.20	1.74	.050 247 15 277	18 05 53
14	17 36 51.897 19.543	23 14 04.14 18.78	18.14	1.74	.065 524 15 294	18 02 16
15	17 37 11.440 +20.279	-23 14 22.92 - 18.99	18.09	1.73	5.080 818 +15 308	17 58 40
16	17 37 31.719 21.010	23 14 41.91 19.17	18.04	1.73	.096 126 15 317	17 55 05
17	17 37 52.729 21.735	23 15 01.08 19.32	17.98	1.72	.111 443 15 322	17 51 30
18	17 38 14.464 22.456	23 15 20.40 19.46	17.93	1.72	.126 765 15 323	17 47 57
19	17 38 36.920 23.171	23 15 39.86 19.56	17.87	1.71	.142 088 15 320	17 44 24
20	17 39 00.091 +23.882	-23 15 59.42 - 19.63	17.82	1.71	5.157 408 +15 313	17 40 51
21	17 39 23.973 24.586	23 16 19.05 19.69	17.77	1.70	.172 721 15 301	17 37 20
22	17 39 48.559 25.286	23 16 38.74 19.72	17.72	1.70	.188 022 15 287	17 33 49
23	17 40 13.845 25.980	23 16 58.46 19.74	17.66	1.69	.203 309 15 268	17 30 19
24	17 40 39.825 26.668	23 17 18.20 19.72	17.61	1.69	.218 577 15 244	17 26 49
25	17 41 06.493 +27.350	-23 17 37.92 - 19.72	17.56	1.68	5.233 821 +15 217	17 23 20
26	17 41 33.843 28.023	23 17 57.64 19.66	17.51	1.68	.249 038 15 186	17 19 52
27	17 42 01.866 28.687	23 18 17.30 19.61	17.46	1.67	.264 224 15 152	17 16 24
28	17 42 30.553 29.341	23 18 36.91 19.53	17.41	1.67	.279 376 15 114	17 12 57
29	17 42 59.894 29.989	23 18 56.44 19.41	17.36	1.66	.294 490 15 072	17 09 31
30	17 43 29.883 +30.625	-23 19 15.85 - 19.27	17.31	1.66	5.309 562 +15 028	17 06 06
Oct. 1	17 44 00.508	23 19 35.12	17.26	1.65	5.324 590	17 02 41

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["] ["]		^h ^m ^s
Oct. 1	17 44 00.508	-23 19 35.12	17.26	1.65	5.324 590	17 02 41
2	17 44 31.762	23 19 54.21	17.21	1.65	5.339 570	16 59 16
3	17 45 03.638	23 20 13.09	17.17	1.64	5.354 499	16 55 52
4	17 45 36.131	23 20 31.70	17.12	1.64	5.369 374	16 52 29
5	17 46 09.234	23 20 50.05	17.07	1.63	5.384 192	16 49 07
6	17 46 42.943	-23 21 08.08	17.02	1.63	5.398 951	16 45 45
7	17 47 17.251	23 21 25.80	16.98	1.63	5.413 648	16 42 23
8	17 47 52.153	23 21 43.17	16.93	1.62	5.428 278	16 39 03
9	17 48 27.642	23 22 00.18	16.89	1.62	5.442 841	16 35 42
10	17 49 03.713	23 22 16.79	16.84	1.61	5.457 332	16 32 23
11	17 49 40.358	-23 22 33.00	16.80	1.61	5.471 748	16 29 04
12	17 50 17.570	23 22 48.77	16.75	1.60	5.486 086	16 25 45
13	17 50 55.343	23 23 04.08	16.71	1.60	5.500 344	16 22 27
14	17 51 33.668	23 23 18.89	16.67	1.60	5.514 518	16 19 10
15	17 52 12.540	23 23 33.19	16.62	1.59	5.528 605	16 15 53
16	17 52 51.951	-23 23 46.95	16.58	1.59	5.542 601	16 12 37
17	17 53 31.896	23 24 00.12	16.54	1.58	5.556 504	16 09 21
18	17 54 12.368	23 24 12.69	16.50	1.58	5.570 311	16 06 06
19	17 54 53.360	23 24 24.61	16.46	1.58	5.584 017	16 02 51
20	17 55 34.869	23 24 35.88	16.42	1.57	5.597 621	15 59 37
21	17 56 16.885	-23 24 46.47	16.38	1.57	5.611 119	15 56 23
22	17 56 59.404	23 24 56.35	16.34	1.56	5.624 507	15 53 10
23	17 57 42.419	23 25 05.50	16.30	1.56	5.637 782	15 49 57
24	17 58 25.920	23 25 13.93	16.26	1.56	5.650 943	15 46 44
25	17 59 09.898	23 25 21.59	16.23	1.55	5.663 985	15 43 33
26	17 59 54.345	-23 25 28.49	16.19	1.55	5.676 907	15 40 21
27	18 00 39.249	23 25 34.57	16.15	1.55	5.689 705	15 37 10
28	18 01 24.601	23 25 39.83	16.12	1.54	5.702 377	15 34 00
29	18 02 10.395	23 25 44.22	16.08	1.54	5.714 922	15 30 50
30	18 02 56.621	23 25 47.70	16.05	1.54	5.727 336	15 27 40
31	18 03 43.273	-23 25 50.27	16.01	1.53	5.739 617	15 24 31
Nov. 1	18 04 30.347	23 25 51.87	15.98	1.53	5.751 765	15 21 22
2	18 05 17.835	23 25 52.50	15.95	1.53	5.763 776	15 18 14
3	18 06 05.731	23 25 52.12	15.91	1.52	5.775 648	15 15 06
4	18 06 54.031	23 25 50.74	15.88	1.52	5.787 380	15 11 58
5	18 07 42.728	-23 25 48.32	15.85	1.52	5.798 970	15 08 51
6	18 08 31.814	23 25 44.86	15.82	1.51	5.810 416	15 05 44
7	18 09 21.284	23 25 40.34	15.79	1.51	5.821 714	15 02 38
8	18 10 11.130	23 25 34.73	15.76	1.51	5.832 864	14 59 32
9	18 11 01.346	23 25 28.01	15.73	1.51	5.843 863	14 56 26
10	18 11 51.924	-23 25 20.18	15.70	1.50	5.854 709	14 53 20
11	18 12 42.857	23 25 11.22	15.67	1.50	5.865 399	14 50 16
12	18 13 34.140	23 25 01.07	15.64	1.50	5.875 932	14 47 11
13	18 14 25.766	23 24 49.74	15.61	1.49	5.886 305	14 44 06
14	18 15 17.727	23 24 37.21	15.59	1.49	5.896 517	14 41 02
15	18 16 10.020	-23 24 23.43	15.56	1.49	5.906 564	14 37 59
16	18 17 02.637	-23 24 08.42	15.53	1.49	5.916 445	14 34 55

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	[°] ['] ["]		^h ^m ^s
Nov. 16	18 17 02.637	+52° 24' 08.42"	15° 53'	1° 49'	5.916 445	14 34 55
17	18 17 55.573	+52° 23' 52.13"	15° 51'	1° 48'	5.926 157	14 31 52
18	18 18 48.823	+53° 23' 34.56"	15° 48'	1° 48'	5.935 699	14 28 50
19	18 19 42.380	+53° 23' 15.70"	15° 46'	1° 48'	5.945 067	14 25 47
20	18 20 36.237	+53° 22' 55.55"	15° 44'	1° 48'	5.954 260	14 22 45
21	18 21 30.385	+53° 22' 34.10"	15° 41'	1° 48'	5.963 276	14 19 43
22	18 22 24.814	+53° 22' 11.34"	15° 39'	1° 47'	5.972 114	14 16 42
23	18 23 19.516	+53° 21' 47.27"	15° 37'	1° 47'	5.980 770	14 13 40
24	18 24 14.479	+55° 23' 21.85"	15° 35'	1° 47'	5.989 245	14 10 39
25	18 25 09.697	+55° 23' 05.08"	15° 32'	1° 47'	5.997 537	14 07 38
26	18 26 05.162	+55° 23' 20.26"	15° 30'	1° 47'	6.005 643	14 04 38
27	18 27 00.866	+55° 23' 19.57"	15° 28'	1° 46'	6.013 564	14 01 38
28	18 27 56.807	+55° 23' 19.26"	15° 26'	1° 46'	6.021 298	13 58 37
29	18 28 52.975	+56° 23' 18.53"	15° 25'	1° 46'	6.028 843	13 55 38
30	18 29 49.368	+56° 23' 18.20"	15° 23'	1° 46'	6.036 200	13 52 38
Dec. 1	18 30 45.979	+56° 23' 17.44"	15° 21'	1° 46'	6.043 366	13 49 38
2	18 31 42.803	+57° 23' 17.08"	15° 19'	1° 45'	6.050 342	13 46 39
3	18 32 39.832	+57° 23' 16.29"	15° 17'	1° 45'	6.057 124	13 43 40
4	18 33 37.061	+57° 23' 15.50"	15° 16'	1° 45'	6.063 714	13 40 41
5	18 34 34.484	+57° 23' 15.09"	15° 14'	1° 45'	6.070 109	13 37 43
6	18 35 32.092	+57° 23' 14.26"	15° 13'	1° 45'	6.076 309	13 34 44
7	18 36 29.881	+57° 23' 13.42"	15° 11'	1° 45'	6.082 311	13 31 46
8	18 37 27.842	+58° 23' 12.57"	15° 10'	1° 45'	6.088 116	13 28 48
9	18 38 25.971	+58° 23' 12.10"	15° 08'	1° 44'	6.093 721	13 25 50
10	18 39 24.261	+58° 23' 11.21"	15° 07'	1° 44'	6.099 126	13 22 52
11	18 40 22.706	+58° 23' 10.31"	15° 06'	1° 44'	6.104 330	13 19 54
12	18 41 21.301	+58° 23' 09.39"	15° 04'	1° 44'	6.109 331	13 16 57
13	18 42 20.041	+58° 23' 08.46"	15° 03'	1° 44'	6.114 128	13 13 59
14	18 43 18.919	+59° 23' 07.52"	15° 02'	1° 44'	6.118 719	13 11 02
15	18 44 17.931	+59° 23' 06.56"	15° 01'	1° 44'	6.123 104	13 08 05
16	18 45 17.072	+59° 23' 05.58"	15° 00'	1° 44'	6.127 282	13 05 08
17	18 46 16.335	+59° 23' 04.59"	14° 59'	1° 44'	6.131 251	13 02 11
18	18 47 15.713	+59° 23' 03.58"	14° 58'	1° 43'	6.135 010	12 59 14
19	18 48 15.197	+59° 23' 02.56"	14° 57'	1° 43'	6.138 558	12 56 18
20	18 49 14.777	+59° 23' 01.52"	14° 56'	1° 43'	6.141 895	12 53 21
21	18 50 14.446	+59° 22' 00.47"	14° 56'	1° 43'	6.145 020	12 50 25
22	18 51 14.193	+59° 22' 59.41"	14° 55'	1° 43'	6.147 932	12 47 28
23	18 52 14.011	+59° 22' 58.33"	14° 54'	1° 43'	6.150 631	12 44 32
24	18 53 13.894	+59° 22' 57.23"	14° 54'	1° 43'	6.153 117	12 41 36
25	18 54 13.837	+59° 22' 56.12"	14° 53'	1° 43'	6.155 390	12 38 39
26	18 55 13.833	+59° 22' 55.59"	14° 53'	1° 43'	6.157 449	12 35 43
27	18 56 13.880	+60° 22' 53.45"	14° 52'	1° 43'	6.159 296	12 32 47
28	18 57 13.970	+60° 22' 52.29"	14° 52'	1° 43'	6.160 929	12 29 51
29	18 58 14.098	+60° 22' 51.12"	14° 51'	1° 43'	6.162 348	12 26 55
30	18 59 14.260	+60° 22' 49.54"	14° 51'	1° 43'	6.163 555	12 23 59
31	19 00 14.447	+60° 22' 48.33"	14° 51'	1° 43'	6.164 548	12 21 03
32	19 01 14.656	+60° 22' 47.12"	14° 51'	1° 43'	6.165 327	12 18 07

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	18 40 28.723 ^s +30.672	-22 34 11.28 ["] +25.72	6.75	0.80	11.045 767 + 46	12 04 03
1	18 40 59.395 30.663	22 33 45.56 ["] 26.14	6.75	.80	.045 813 - 218	12 00 38
2	18 41 30.058 30.649	22 33 19.42 ["] 26.54	6.75	.80	.045 595 481	11 57 13
3	18 42 00.707 30.631	22 32 52.88 ["] 26.96	6.75	.80	.045 114 743	11 53 47
4	18 42 31.338 30.611	22 32 25.92 ["] 27.36	6.75	.80	.044 371 1 007	11 50 22
5	18 43 01.949 +30.584	-22 31 58.56 ["] +27.77	6.75	0.80	11.043 364 - 1 267	11 46 56
6	18 43 32.533 30.554	22 31 30.79 ["] 28.16	6.75	.80	.042 097 1 529	11 43 31
7	18 44 03.087 30.520	22 31 02.63 ["] 28.56	6.75	.80	.040 568 1 790	11 40 05
8	18 44 33.607 30.482	22 30 34.07 ["] 28.92	6.76	.80	.038 778 2 048	11 36 40
9	18 45 04.089 30.438	22 30 05.15 ["] 29.30	6.76	.80	.036 730 2 308	11 33 14
10	18 45 34.527 +30.389	-22 29 35.85 ["] +29.64	6.76	0.80	11.034 422 - 2 567	11 29 48
11	18 46 04.916 30.335	22 29 06.21 ["] 29.99	6.76	.80	.031 855 2 824	11 26 23
12	18 46 35.251 30.276	22 28 36.22 ["] 30.32	6.76	.80	.029 031 3 081	11 22 57
13	18 47 05.527 30.212	22 28 05.90 ["] 30.65	6.76	.80	.025 950 3 337	11 19 31
14	18 47 35.739 30.141	22 27 35.25 ["] 30.96	6.77	.80	.022 613 3 592	11 16 05
15	18 48 05.880 +30.066	-22 27 04.29 ["] +31.27	6.77	0.80	11.019 021 - 3 847	11 12 39
16	18 48 35.946 29.987	22 26 33.02 ["] 31.58	6.77	.80	.015 174 4 101	11 09 13
17	18 49 05.933 29.901	22 26 01.44 ["] 31.89	6.77	.80	.011 073 4 354	11 05 47
18	18 49 35.834 29.813	22 25 29.55 ["] 32.18	6.77	.80	.006 719 4 606	11 02 21
19	18 50 05.647 29.721	22 24 57.37 ["] 32.49	6.78	.80	11.002 113 4 857	10 58 55
20	18 50 35.368 +29.624	-22 24 24.88 ["] +32.76	6.78	0.80	10.997 256 - 5 109	10 55 28
21	18 51 04.992 29.524	22 23 52.12 ["] 33.05	6.78	.80	.992 147 5 358	10 52 02
22	18 51 34.516 29.421	22 23 19.07 ["] 33.30	6.79	.80	.986 789 5 607	10 48 35
23	18 52 03.937 29.311	22 22 45.77 ["] 33.55	6.79	.80	.981 182 5 856	10 45 08
24	18 52 33.248 29.197	22 22 12.22 ["] 33.77	6.79	.80	.975 326 6 102	10 41 42
25	18 53 02.445 +29.076	-22 21 38.45 ["] +33.97	6.80	0.80	10.969 224 - 6 349	10 38 15
26	18 53 31.521 28.948	22 21 04.48 ["] 34.16	6.80	.80	.962 875 6 592	10 34 48
27	18 54 00.469 28.813	22 20 30.32 ["] 34.34	6.81	.80	.956 283 6 836	10 31 21
28	18 54 29.282 28.670	22 19 55.98 ["] 34.50	6.81	.80	.949 447 7 077	10 27 53
29	18 54 57.952 28.522	22 19 21.48 ["] 34.67	6.81	.80	.942 370 7 316	10 24 26
30	18 55 26.474 +28.369	-22 18 46.81 ["] +34.83	6.82	0.80	10.935 054 - 7 553	10 20 58
31	18 55 54.843 28.214	22 18 11.98 ["] 35.00	6.82	.81	.927 501 7 788	10 17 30
Feb. 1	18 56 23.057 28.053	22 17 36.98 ["] 35.14	6.83	.81	.919 713 8 021	10 14 03
2	18 56 51.110 27.888	22 17 01.84 ["] 35.27	6.83	.81	.911 692 8 252	10 10 35
3	18 57 18.998 27.722	22 16 26.57 ["] 35.40	6.84	.81	.903 440 8 479	10 07 06
4	18 57 46.720 +27.549	-22 15 51.17 ["] +35.49	6.84	0.81	10.894 961 - 8 706	10 03 38
5	18 58 14.269 27.373	22 15 15.68 ["] 35.59	6.85	.81	.886 255 8 929	10 00 09
6	18 58 41.642 27.191	22 14 40.09 ["] 35.66	6.86	.81	.877 326 9 150	9 56 41
7	18 59 08.833 27.005	22 14 04.43 ["] 35.71	6.86	.81	.868 176 9 369	9 53 12
8	18 59 35.838 26.814	22 13 28.72 ["] 35.74	6.87	.81	.858 807 9 585	9 49 43
9	19 00 02.652 +26.618	-22 12 52.98 ["] +35.78	6.87	0.81	10.849 222 - 9 799	9 46 13
10	19 00 29.270 26.416	22 12 17.20 ["] 35.78	6.88	.81	.839 423 10 011	9 42 44
11	19 00 55.686 26.211	22 11 41.42 ["] 35.78	6.89	.81	.829 412 10 220	9 39 14
12	19 01 21.897 25.999	22 11 05.64 ["] 35.78	6.89	.81	.819 192 10 427	9 35 44
13	19 01 47.896 25.786	22 10 29.86 ["] 35.76	6.90	.81	.808 765 10 632	9 32 14
14	19 02 13.682 +25.566	-22 09 54.10 ["] +35.73	6.91	0.81	10.798 133 - 10 834	9 28 44
15	19 02 39.248	22 09 18.37 ["]	6.91	0.82	10.787 299	9 25 13

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Feb. 15	19 02 39.248 +25.345	-22 09 18.37 +35.70	6.91	0.82	10.787 299	9 25 13
16	19 03 04.593 25.118	22 08 42.67 35.66	6.92	.82	.776 265	9 21 42
17	19 03 29.711 24.891	22 08 07.01 35.59	6.93	.82	.765 034	9 18 11
18	19 03 54.602 24.658	22 07 31.42 35.52	6.93	.82	.753 608	9 14 40
19	19 04 19.260 24.422	22 06 55.90 35.42	6.94	.82	.741 989	9 11 09
20	19 04 43.682 +24.181	-22 06 20.48 +35.29	6.95	0.82	10.730 179	9 07 37
21	19 05 07.863 23.935	22 05 45.19 35.16	6.96	.82	.718 182	9 04 05
22	19 05 31.798 23.680	22 05 10.03 34.98	6.97	.82	.706 000	9 00 33
23	19 05 55.478 23.422	22 04 35.05 34.79	6.97	.82	.693 635	8 57 00
24	19 06 18.900 23.156	22 04 00.26 34.60	6.98	.82	.681 092	8 53 28
25	19 06 42.056 +22.884	-22 03 25.66 +34.40	6.99	0.82	10.668 372	8 49 55
26	19 07 04.940 22.608	22 02 51.26 34.19	7.00	.83	.655 479	8 46 21
27	19 07 27.548 22.329	22 02 17.07 33.97	7.01	.83	.642 417	8 42 48
28	19 07 49.877 22.045	22 01 43.10 33.75	7.02	.83	.629 189	8 39 14
29	19 08 11.922 21.760	22 01 09.35 33.50	7.02	.83	.615 798	8 35 40
Mar. 1	19 08 33.682 +21.471	-22 00 35.85 +33.24	7.03	0.83	10.602 250	8 32 06
2	19 08 55.153 21.178	22 00 02.61 32.98	7.04	.83	.588 546	8 28 31
3	19 09 16.331 20.882	21 59 29.63 32.67	7.05	.83	.574 692	8 24 56
4	19 09 37.213 20.581	21 58 56.96 32.37	7.06	.83	.560 690	8 21 21
5	19 09 57.794 20.278	21 58 24.59 32.03	7.07	.83	.546 545	8 17 45
6	19 10 18.072 +19.969	-21 57 52.56 +31.68	7.08	0.84	10.532 260	8 14 09
7	19 10 38.041 19.657	21 57 20.88 31.32	7.09	.84	.517 839	8 10 33
8	19 10 57.698 19.340	21 56 49.56 30.94	7.10	.84	.503 286	8 06 57
9	19 11 17.038 19.019	21 56 18.62 30.56	7.11	.84	.488 604	8 03 20
10	19 11 36.057 18.695	21 55 48.06 30.14	7.12	.84	.473 798	7 59 43
11	19 11 54.752 +18.367	-21 55 17.92 +29.74	7.13	0.84	10.458 870	7 56 05
12	19 12 13.119 18.035	21 54 48.18 29.32	7.14	.84	.443 825	7 52 28
13	19 12 31.154 17.703	21 54 18.86 28.89	7.15	.84	.428 666	7 48 50
14	19 12 48.857 17.367	21 53 49.97 28.46	7.16	.85	.413 396	7 45 11
15	19 13 06.224 17.029	21 53 21.51 28.01	7.17	.85	.398 020	7 41 32
16	19 13 23.253 +16.688	-21 52 53.50 +27.54	7.18	0.85	10.382 541	7 37 53
17	19 13 39.941 16.347	21 52 25.96 27.06	7.19	.85	.366 962	7 34 14
18	19 13 56.288 15.999	21 51 58.90 26.54	7.20	.85	.351 287	7 30 34
19	19 14 12.287 15.647	21 51 32.36 26.02	7.21	.85	.335 519	7 26 54
20	19 14 27.934 15.292	21 51 06.34 25.47	7.23	.85	.319 664	7 23 14
21	19 14 43.226 +14.931	-21 50 40.87 +24.90	7.24	0.85	10.303 723	7 19 33
22	19 14 58.157 14.564	21 50 15.97 24.32	7.25	.86	.287 702	7 15 52
23	19 15 12.721 14.193	21 49 51.65 23.74	7.26	.86	.271 605	7 12 10
24	19 15 26.914 13.819	21 49 27.91 23.14	7.27	.86	.255 436	7 08 28
25	19 15 40.733 13.442	21 49 04.77 22.55	7.28	.86	.239 199	7 04 46
26	19 15 54.175 +13.062	-21 48 42.22 +21.95	7.29	0.86	10.222 899	7 01 03
27	19 16 07.237 12.682	21 48 20.27 21.33	7.31	.86	.206 540	6 57 20
28	19 16 19.919 12.299	21 47 58.94 20.72	7.32	.86	.190 128	6 53 37
29	19 16 32.218 11.915	21 47 38.22 20.08	7.33	.86	.173 667	6 49 53
30	19 16 44.133 11.529	21 47 18.14 19.43	7.34	.87	.157 162	6 46 09
31	19 16 55.662 +11.139	-21 46 58.71 +18.77	7.35	0.87	10.140 617	6 42 24
Apr. 1	19 17 06.801	-21 46 39.94	7.37	0.87	10.124 037	6 38 40

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	19 17 06.801 ^s	-21 46 39.94 ["]	7.37	0.87	10.124 037	6 38 40
2	19 17 17.550 ^{+10.749}	21 46 21.86 ^{+18.08}	7.38	.87	.107 427	6 34 54
3	19 17 27.904 ^{10.354}	21 46 04.46 ^{17.40}	7.39	.87	.090 792	6 31 09
4	19 17 37.862 ^{9.958}	21 45 47.78 ^{16.68}	7.40	.87	.074 135	6 27 22
5	19 17 47.422 ^{9.560}	21 45 31.81 ^{15.97}	7.41	.87	.057 463	6 23 36
	^{9.159}	^{15.25}			^{16 685}	
6	19 17 56.581 ⁺	-21 45 16.56 ^{+14.52}	7.43	0.88	10.040 778	6 19 49
7	19 18 05.337 ^{8.756}	21 45 02.04 ^{13.80}	7.44	.88	.024 086	6 16 02
8	19 18 13.688 ^{8.351}	21 44 48.24 ^{13.06}	7.45	.88	10.007 392	6 12 14
9	19 18 21.633 ^{7.945}	21 44 35.18 ^{12.32}	7.46	.88	9.990 699	6 08 26
10	19 18 29.172 ^{7.539}	21 44 22.86 ^{11.59}	7.48	.88	.974 012	6 04 37
	^{7.132}				^{16 677}	
11	19 18 36.304 ⁺	-21 44 11.27 ^{+10.85}	7.49	0.88	9.957 335	6 00 48
12	19 18 43.029 ^{6.725}	21 44 00.42 ^{10.10}	7.50	.89	.940 673	5 56 59
13	19 18 49.348 ^{6.319}	21 43 50.32 ^{9.34}	7.51	.89	.924 029	5 53 09
14	19 18 55.258 ^{5.910}	21 43 40.98 ^{8.56}	7.53	.89	.907 408	5 49 19
15	19 19 00.762 ^{5.504}	21 43 32.42 ^{7.77}	7.54	.89	.890 814	5 45 29
	^{5.092}				^{16 562}	
16	19 19 05.854 ⁺	-21 43 24.65 ^{+6.97}	7.55	0.89	9.874 252	5 41 38
17	19 19 10.532 ^{4.678}	21 43 17.68 ^{6.15}	7.56	.89	.857 725	5 37 47
18	19 19 14.795 ^{4.263}	21 43 11.53 ^{5.33}	7.58	.89	.841 239	5 33 55
19	19 19 18.638 ^{3.843}	21 43 06.20 ^{4.51}	7.59	.90	.824 798	5 30 03
20	19 19 22.060 ^{3.422}	21 43 01.69 ^{3.70}	7.60	.90	.808 407	5 26 10
	^{3.000}				^{16 337}	
21	19 19 25.060 ⁺	-21 42 57.99 ^{+2.89}	7.62	0.90	9.792 070	5 22 17
22	19 19 27.636 ^{2.576}	21 42 55.10 ^{2.08}	7.63	.90	.775 793	5 18 23
23	19 19 29.791 ^{2.155}	21 42 53.02 ^{1.28}	7.64	.90	.759 581	5 14 30
24	19 19 31.524 ^{1.733}	21 42 51.74 ^{+0.47}	7.65	.90	.743 438	5 10 35
25	19 19 32.837 ^{1.313}	21 42 51.27 ^{-0.33}	7.67	.90	.727 370	5 06 41
	^{0.893}				^{15 989}	
26	19 19 33.730 ⁺	-21 42 51.60 ^{-1.16}	7.68	0.91	9.711 381	5 02 46
27	19 19 34.204 ^{0.474}	21 42 52.76 ^{1.97}	7.69	.91	.695 477	4 58 50
28	19 19 34.261 ^{0.057}	21 42 54.73 ^{2.79}	7.70	.91	.679 663	4 54 54
29	19 19 33.900 ^{-0.361}	21 42 57.52 ^{3.62}	7.72	.91	.663 943	4 50 58
30	19 19 33.122 ^{0.778}	21 43 01.14 ^{4.43}	7.73	.91	.648 322	4 47 01
	^{1.194}				^{15 516}	
May 1	19 19 31.928 ⁻	-21 43 05.57 ^{-5.27}	7.74	0.91	9.632 806	4 43 04
2	19 19 30.319 ^{1.609}	21 43 10.84 ^{6.09}	7.75	.92	.617 398	4 39 06
3	19 19 28.295 ^{2.024}	21 43 16.93 ^{6.89}	7.77	.92	.602 103	4 35 08
4	19 19 25.857 ^{2.438}	21 43 23.82 ^{7.71}	7.78	.92	.586 927	4 31 10
5	19 19 23.008 ^{2.849}	21 43 31.53 ^{8.51}	7.79	.92	.571 872	4 27 11
	^{3.259}				^{14 927}	
6	19 19 19.749 ⁻	-21 43 40.04 ^{-9.31}	7.80	0.92	9.556 945	4 23 12
7	19 19 16.082 ^{3.667}	21 43 49.35 ^{10.08}	7.81	.92	.542 149	4 19 12
8	19 19 12.012 ^{4.070}	21 43 59.43 ^{10.84}	7.83	.92	.527 488	4 15 12
9	19 19 07.540 ^{4.472}	21 44 10.27 ^{11.61}	7.84	.93	.512 966	4 11 12
10	19 19 02.671 ^{4.869}	21 44 21.88 ^{12.37}	7.85	.93	.498 588	4 07 11
	^{5.262}				^{14 231}	
11	19 18 57.409 ⁻	-21 44 34.25 ^{-13.14}	7.86	0.93	9.484 357	4 03 10
12	19 18 51.757 ^{5.652}	21 44 47.39 ^{13.90}	7.87	.93	.470 277	3 59 08
13	19 18 45.716 ^{6.041}	21 45 01.29 ^{14.67}	7.89	.93	.456 353	3 55 06
14	19 18 39.287 ^{6.429}	21 45 15.96 ^{15.44}	7.90	.93	.442 588	3 51 04
15	19 18 32.472 ^{6.815}	21 45 31.40 ^{16.21}	7.91	.93	.428 986	3 47 01
	^{7.202}				^{13 434}	
16	19 18 25.270 ⁻	-21 45 47.61 ^{-16.96}	7.92	0.93	9.415 552	3 42 58
17	19 18 17.683 ^{7.587}	-21 46 04.57	7.93	0.94	9.402 289	3 38 54

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
May 17	19 18 17.683	-21 46 04.57	7.93	0.94	9.402 289	3 38 54
18	19 18 09.714	-21 46 22.25	7.94	.94	389 203	3 34 50
19	19 18 01.367	-21 46 40.66	7.95	.94	376 297	3 30 46
20	19 17 52.646	-21 46 59.76	7.96	.94	363 576	3 26 42
21	19 17 43.556	-21 47 19.54	7.97	.94	351 044	3 22 37
22	19 17 34.101	-21 47 40.00	7.99	0.94	9.338 706	3 18 31
23	19 17 24.287	-21 48 01.11	8.00	.94	326 566	3 14 25
24	19 17 14.119	-21 48 22.88	8.01	.94	314 628	3 10 19
25	19 17 03.603	-21 48 45.29	8.02	.95	302 896	3 06 13
26	19 16 52.743	-21 49 08.34	8.03	.95	291 374	3 02 06
27	19 16 41.544	-21 49 32.02	8.04	0.95	9.280 067	2 57 59
28	19 16 30.011	-21 49 56.31	8.05	.95	268 977	2 53 52
29	19 16 18.150	-21 50 21.20	8.05	.95	258 109	2 49 44
30	19 16 05.965	-21 50 46.67	8.06	.95	247 467	2 45 36
31	19 15 53.462	-21 51 12.72	8.07	.95	237 053	2 41 28
June 1	19 15 40.647	-21 51 39.32	8.08	0.95	9.226 871	2 37 19
2	19 15 27.527	-21 52 06.45	8.09	.95	216 925	2 33 10
3	19 15 14.107	-21 52 34.10	8.10	.96	207 217	2 29 01
4	19 15 00.396	-21 53 02.23	8.11	.96	197 750	2 24 51
5	19 14 46.400	-21 53 30.84	8.12	.96	188 527	2 20 41
6	19 14 32.129	-21 53 59.90	8.12	0.96	9.179 552	2 16 31
7	19 14 17.591	-21 54 29.38	8.13	.96	170 826	2 12 21
8	19 14 02.793	-21 54 59.30	8.14	.96	162 351	2 08 10
9	19 13 47.742	-21 55 29.63	8.15	.96	154 131	2 03 59
10	19 13 32.445	-21 56 00.38	8.15	.96	146 168	1 59 48
11	19 13 16.905	-21 56 31.53	8.16	0.96	9.138 464	1 55 37
12	19 13 01.128	-21 57 03.07	8.17	.96	131 021	1 51 25
13	19 12 45.120	-21 57 34.99	8.17	.96	123 843	1 47 13
14	19 12 28.885	-21 58 07.25	8.18	.97	116 931	1 43 01
15	19 12 12.433	-21 58 39.84	8.19	.97	110 288	1 38 49
16	19 11 55.771	-21 59 12.72	8.19	0.97	9.103 918	1 34 36
17	19 11 38.909	-21 59 45.86	8.20	.97	097 822	1 30 24
18	19 11 21.856	-22 00 19.26	8.20	.97	092 003	1 26 11
19	19 11 04.620	-22 00 52.90	8.21	.97	086 463	1 21 58
20	19 10 47.213	-22 01 26.75	8.21	.97	081 204	1 17 44
21	19 10 29.642	-22 02 00.81	8.22	0.97	9.076 229	1 13 31
22	19 10 11.916	-22 02 35.05	8.22	.97	071 540	1 09 17
23	19 09 54.045	-22 03 09.48	8.22	.97	067 138	1 05 04
24	19 09 36.036	-22 03 44.06	8.23	.97	063 025	1 00 50
25	19 09 17.899	-22 04 18.79	8.23	.97	059 202	0 56 36
26	19 08 59.643	-22 04 53.65	8.23	0.97	9.055 672	0 52 22
27	19 08 41.276	-22 05 28.61	8.24	.97	052 434	0 48 08
28	19 08 22.809	-22 06 03.65	8.24	.97	049 491	0 43 53
29	19 08 04.249	-22 06 38.76	8.24	.97	046 842	0 39 39
30	19 07 45.607	-22 07 13.92	8.24	.97	044 490	0 35 25
July 1	19 07 26.895	-22 07 49.09	8.25	0.97	9.042 433	0 31 10
2	19 07 08.122	-22 08 24.25	8.25	0.97	9.040 674	0 26 56

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Date	Apparent Right Ascension		Apparent Declination		Polar S.D.	Hor. Par.	True Distance from the Earth		Ephem- eris Transit	
	^h ^m ^s	^s	[°] ['] ["]	["]	["]	["]			^h ^m ^s	
July	1	19 07 26.895	-18.773	-22 07 49.09	-35.16	8.25	0.97	9.042 433	- 1 759	0 31 10
	2	19 07 08.122	18.825	22 08 24.25	35.15	8.25	.97	.040 674	1 463	0 26 56
	3	19 06 49.297	18.863	22 08 59.40	35.10	8.25	.97	.039 211	1 165	0 22 41
	4	19 06 30.434	18.892	22 09 34.50	35.06	8.25	.97	.038 046	869	0 18 26
	5	19 06 11.542	18.911	22 10 09.56	34.99	8.25	.97	.037 177	571	0 14 12
	6	19 05 52.631	-18.920	-22 10 44.55	-34.92	8.25	0.97	9.036 606	- 275	0 09 57
	7	19 05 33.711	18.923	22 11 19.47	34.86	8.25	.97	.036 331	+ 22	0 05 42
	8	19 05 14.788	18.918	22 11 54.33	34.78	8.25	.97	.036 353	318	{ 0 01 27 }
	9	19 04 55.870	18.906	22 12 29.11	34.68	8.25	.97	.036 671	615	{ 23 57 13 }
	10	19 04 36.964	18.887	22 13 03.79	34.57	8.25	.97	.037 286	911	23 52 58
	11	19 04 18.077	-18.859	-22 13 38.36	-34.43	8.25	0.97	9.038 197	+ 1 206	23 48 43
	12	19 03 59.218	18.822	22 14 12.79	34.26	8.25	.97	.039 403	1 503	23 44 29
	13	19 03 40.396	18.774	22 14 47.05	34.08	8.25	.97	.040 906	1 798	23 40 14
	14	19 03 21.622	18.714	22 15 21.13	33.88	8.25	.97	.042 704	2 094	23 35 59
	15	19 03 02.908	18.646	22 15 55.01	33.66	8.24	.97	.044 798	2 390	23 31 45
	16	19 02 44.262	-18.566	-22 16 28.67	-33.44	8.24	0.97	9.047 188	+ 2 684	23 27 30
	17	19 02 25.696	18.476	22 17 02.11	33.20	8.24	.97	.049 872	2 978	23 23 16
	18	19 02 07.220	18.377	22 17 35.31	32.96	8.24	.97	.052 850	3 271	23 19 02
	19	19 01 48.843	18.268	22 18 08.27	32.71	8.23	.97	.056 121	3 564	23 14 48
	20	19 01 30.575	18.150	22 18 40.98	32.45	8.23	.97	.059 685	3 855	23 10 34
	21	19 01 12.425	-18.023	-22 19 13.43	-32.18	8.23	0.97	9.063 540	+ 4 146	23 06 20
	22	19 00 54.402	17.888	22 19 45.61	31.90	8.22	.97	.067 686	4 434	23 02 06
	23	19 00 36.514	17.743	22 20 17.51	31.61	8.22	.97	.072 120	4 720	22 57 52
	24	19 00 18.771	17.590	22 20 49.12	31.30	8.22	.97	.076 840	5 007	22 53 39
	25	19 00 01.181	17.427	22 21 20.42	30.98	8.21	.97	.081 847	5 290	22 49 25
	26	18 59 43.754	-17.255	-22 21 51.40	-30.64	8.21	0.97	9.087 137	+ 5 572	22 45 12
	27	18 59 26.499	17.075	22 22 22.04	30.29	8.20	.97	.092 709	5 850	22 40 59
	28	18 59 09.424	16.883	22 22 52.33	29.93	8.20	.97	.098 559	6 129	22 36 46
	29	18 58 52.541	16.684	22 23 22.26	29.56	8.19	.97	.104 688	6 402	22 32 33
	30	18 58 35.857	16.473	22 23 51.82	29.16	8.18	.97	.111 090	6 675	22 28 21
Aug.	31	18 58 19.384	-16.255	-22 24 20.98	-28.78	8.18	0.97	9.117 765	+ 6 944	22 24 08
	1	18 58 03.129	16.027	22 24 49.76	28.39	8.17	.96	.124 709	7 211	22 19 56
	2	18 57 47.102	15.791	22 25 18.15	27.99	8.17	.96	.131 920	7 475	22 15 44
	3	18 57 31.311	15.549	22 25 46.14	27.61	8.16	.96	.139 395	7 735	22 11 33
	4	18 57 15.762	15.302	22 26 13.75	27.23	8.15	.96	.147 130	7 994	22 07 21
	5	18 57 00.460	-15.049	-22 26 40.98	-26.83	8.15	0.96	9.155 124	+ 8 249	22 03 10
	6	18 56 45.411	14.792	22 27 07.81	26.43	8.14	.96	.163 373	8 502	21 58 59
	7	18 56 30.619	14.529	22 27 34.24	26.02	8.13	.96	.171 875	8 752	21 54 49
	8	18 56 16.090	14.260	22 28 00.26	25.59	8.12	.96	.180 627	8 999	21 50 38
	9	18 56 01.830	13.981	22 28 25.85	25.14	8.11	.96	.189 626	9 244	21 46 28
	10	18 55 47.849	-13.696	-22 28 50.99	-24.69	8.11	0.96	9.198 870	+ 9 486	21 42 18
	11	18 55 34.153	13.403	22 29 15.68	24.22	8.10	.96	.208 356	9 725	21 38 09
	12	18 55 20.750	13.102	22 29 39.90	23.77	8.09	.95	.218 081	9 961	21 34 00
	13	18 55 07.648	12.794	22 30 03.67	23.29	8.08	.95	.228 042	10 195	21 29 51
	14	18 54 54.854	12.479	22 30 26.96	22.84	8.07	.95	.238 237	10 425	21 25 42
	15	18 54 42.375	-12.158	-22 30 49.80	-22.37	8.06	0.95	9.248 662	+ 10 652	21 21 34
16	18 54 30.217		-22 31 12.17		8.05	0.95	9.259 314		21 17 26	

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	18 54 30.217	-22 31 12.17	8.05	0.95	9.259 314	21 13 18
17	18 54 18.385	22 31 34.08	8.04	.95	.270 191	21 09 10
18	18 54 06.885	22 31 55.52	8.03	.95	.281 287	21 05 03
19	18 53 55.723	22 32 16.50	8.02	.95	.292 600	21 00 57
20	18 53 44.903	22 32 37.00	8.01	.95	.304 126	20 56 50
21	18 53 34.431	-22 32 57.02	8.00	0.94	9.315 861	20 52 44
22	18 53 24.311	22 33 16.56	7.99	.94	.327 801	20 48 39
23	18 53 14.549	22 33 35.61	7.98	.94	.339 943	20 44 33
24	18 53 05.151	22 33 54.16	7.97	.94	.352 282	20 40 28
25	18 52 56.122	22 34 12.19	7.96	.94	.364 813	20 36 24
26	18 52 47.466	-22 34 29.72	7.95	0.94	9.377 533	20 32 20
27	18 52 39.191	22 34 46.73	7.94	.94	.390 437	20 28 16
28	18 52 31.300	22 35 03.22	7.93	.94	.403 521	20 24 12
29	18 52 23.798	22 35 19.21	7.92	.93	.416 779	20 20 09
30	18 52 16.688	22 35 34.69	7.91	.93	.430 208	20 16 07
31	18 52 09.972	-22 35 49.67	7.90	0.93	9.443 803	20 12 05
Sept. 1	18 52 03.654	22 36 04.16	7.88	.93	.457 560	20 08 03
2	18 51 57.733	22 36 18.15	7.87	.93	.471 473	20 04 01
3	18 51 52.210	22 36 31.66	7.86	.93	.485 539	20 00 00
4	18 51 47.085	22 36 44.66	7.85	.93	.499 754	19 55 59
5	18 51 42.361	-22 36 57.15	7.84	0.92	9.514 113	19 51 59
6	18 51 38.041	22 37 09.13	7.83	.92	.528 613	19 47 59
7	18 51 34.127	22 37 20.57	7.81	.92	.543 248	19 44 00
8	18 51 30.623	22 37 31.47	7.80	.92	.558 015	19 40 01
9	18 51 27.532	22 37 41.84	7.79	.92	.572 911	19 36 02
10	18 51 24.857	-22 37 51.68	7.78	0.92	9.587 930	19 32 04
11	18 51 22.600	22 38 00.99	7.77	.92	.603 069	19 28 06
12	18 51 20.762	22 38 09.78	7.75	.91	.618 323	19 24 09
13	18 51 19.346	22 38 18.04	7.74	.91	.633 688	19 20 12
14	18 51 18.350	22 38 25.78	7.73	.91	.649 159	19 16 15
15	18 51 17.778	-22 38 33.00	7.72	0.91	9.664 732	19 12 19
16	18 51 17.629	22 38 39.70	7.70	.91	.680 402	19 08 23
17	18 51 17.904	22 38 45.87	7.69	.91	.696 165	19 04 28
18	18 51 18.602	22 38 51.51	7.68	.91	.712 015	19 00 33
19	18 51 19.725	22 38 56.62	7.67	.90	.727 947	18 56 39
20	18 51 21.275	-22 39 01.19	7.65	0.90	9.743 958	18 52 45
21	18 51 23.251	22 39 05.19	7.64	.90	.760 041	18 48 51
22	18 51 25.654	22 39 08.65	7.63	.90	.776 193	18 44 58
23	18 51 28.486	22 39 11.55	7.62	.90	.792 407	18 41 05
24	18 51 31.749	22 39 13.88	7.60	.90	.808 679	18 37 13
25	18 51 35.441	-22 39 15.67	7.59	0.90	9.825 003	18 33 21
26	18 51 39.562	22 39 16.91	7.58	.89	.841 375	18 29 29
27	18 51 44.111	22 39 17.60	7.56	.89	.857 789	18 25 38
28	18 51 49.086	22 39 17.76	7.55	.89	.874 242	18 21 48
29	18 51 54.482	22 39 17.39	7.54	.89	.890 726	18 17 57
30	18 52 00.298	-22 39 16.49	7.53	0.89	9.907 239	18 14 08
Oct. 1	18 52 06.531	22 39 15.05	7.51	0.89	9.923 776	18 10 18

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	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct.	1 18 52 06.531 + 6.646	-22 39 15.05 + 1.99	7.51	0.89	9.923 776 +16 556	18 10 18
	2 18 52 13.177 7.059	22 39 13.06 + 2.56	7.50	.89	.940 332 16 570	18 06 29
	3 18 52 20.236 7.470	22 39 10.50 3.13	7.49	.88	.956 902 16 581	18 02 41
	4 18 52 27.706 7.881	22 39 07.37 3.70	7.48	.88	.973 483 16 586	17 58 53
	5 18 52 35.587 8.291	22 39 03.67 4.27	7.46	.88	9.990 069 16 589	17 55 05
	6 18 52 43.878 + 8.702	-22 38 59.40 + 4.86	7.45	0.88	10.006 658 +16 587	17 51 17
	7 18 52 52.580 9.109	22 38 54.54 5.43	7.44	.88	.023 245 16 580	17 47 30
	8 18 53 01.689 9.517	22 38 49.11 6.00	7.43	.88	.039 825 16 569	17 43 44
	9 18 53 11.206 9.920	22 38 43.11 6.58	7.42	.88	.056 394 16 554	17 39 58
	10 18 53 21.126 10.323	22 38 36.53 7.14	7.40	.87	.072 948 16 534	17 36 12
	11 18 53 31.449 +10.722	-22 38 29.39 + 7.70	7.39	0.87	10.089 482 +16 510	17 32 27
	12 18 53 42.171 11.119	22 38 21.69 8.28	7.38	.87	.105 992 16 482	17 28 42
	13 18 53 53.290 11.513	22 38 13.41 8.85	7.37	.87	.122 474 16 448	17 24 57
	14 18 54 04.803 11.904	22 38 04.56 9.44	7.35	.87	.138 922 16 412	17 21 13
	15 18 54 16.707 12.293	22 37 55.12 10.01	7.34	.87	.155 334 16 368	17 17 29
	16 18 54 29.000 +12.679	-22 37 45.11 +10.61	7.33	0.87	10.171 702 +16 322	17 13 46
	17 18 54 41.679 13.063	22 37 34.50 11.21	7.32	.86	.188 024 16 271	17 10 03
	18 18 54 54.742 13.445	22 37 23.29 11.81	7.31	.86	.204 295 16 215	17 06 20
	19 18 55 08.187 13.826	22 37 11.48 12.43	7.30	.86	.220 510 16 154	17 02 38
	20 18 55 22.013 14.204	22 36 59.05 13.05	7.28	.86	.236 664 16 088	16 58 56
	21 18 55 36.217 +14.581	-22 36 46.00 +13.65	7.27	0.86	10.252 752 +16 018	16 55 15
	22 18 55 50.798 14.955	22 36 32.35 14.27	7.26	.86	.268 770 15 944	16 51 33
	23 18 56 05.753 15.324	22 36 18.08 14.85	7.25	.86	.284 714 15 864	16 47 53
	24 18 56 21.077 15.689	22 36 03.23 15.46	7.24	.85	.300 578 15 781	16 44 12
	25 18 56 36.766 16.047	22 35 47.77 16.04	7.23	.85	.316 359 15 692	16 40 32
	26 18 56 52.813 +16.402	-22 35 31.73 +16.62	7.22	0.85	10.332 051 +15 600	16 36 52
	27 18 57 09.215 16.748	22 35 15.11 17.24	7.21	.85	.347 651 15 505	16 33 13
	28 18 57 25.963 17.093	22 34 57.87 17.83	7.20	.85	.363 156 15 404	16 29 34
	29 18 57 43.056 17.432	22 34 40.04 18.44	7.19	.85	.378 560 15 300	16 25 55
	30 18 58 00.488 17.768	22 34 21.60 19.07	7.17	.85	.393 860 15 192	16 22 17
Nov.	31 18 58 18.256 +18.101	-22 34 02.53 +19.71	7.16	0.85	10.409 052 +15 082	16 18 39
	1 18 58 36.357 18.432	22 33 42.82 20.33	7.15	.84	.424 134 14 967	16 15 01
	2 18 58 54.789 18.759	22 33 22.49 20.98	7.14	.84	.439 101 14 849	16 11 24
	3 18 59 13.548 19.084	22 33 01.51 21.61	7.13	.84	.453 950 14 728	16 07 47
	4 18 59 32.632 19.405	22 32 39.90 22.23	7.12	.84	.468 678 14 602	16 04 10
	5 18 59 52.037 +19.722	-22 32 17.67 +22.86	7.11	0.84	10.483 280 +14 474	16 00 34
	6 19 00 11.759 20.035	22 31 54.81 23.49	7.10	.84	.497 754 14 342	15 56 58
	7 19 00 31.794 20.343	22 31 31.32 24.10	7.09	.84	.512 096 14 206	15 53 22
	8 19 00 52.137 20.647	22 31 07.22 24.73	7.08	.84	.526 302 14 068	15 49 47
	9 19 01 12.784 20.945	22 30 42.49 25.35	7.07	.83	.540 370 13 924	15 46 11
	10 19 01 33.729 +21.240	-22 30 17.14 +25.98	7.07	0.83	10.554 294 +13 778	15 42 36
	11 19 01 54.969 21.532	22 29 51.16 26.61	7.06	.83	.568 072 13 628	15 39 02
	12 19 02 16.501 21.817	22 29 24.55 27.25	7.05	.83	.581 700 13 475	15 35 28
	13 19 02 38.318 22.100	22 28 57.30 27.90	7.04	.83	.595 175 13 318	15 31 54
	14 19 03 00.418 22.379	22 28 29.40 28.54	7.03	.83	.608 493 13 157	15 28 20
	15 19 03 22.797 +22.655	-22 28 00.86 +29.19	7.02	0.83	10.621 650 +12 992	15 24 46
	16 19 03 45.452	-22 27 31.67	7.01	0.83	10.634 642	15 21 13

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	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	19 03 45.452	+22 27 31.67	7.01	0.83	10.634 642	15 21 13
17	19 04 08.380	+22 27 01.81	7.00	.83	10.647 467	15 17 40
18	19 04 31.577	+22 26 31.31	7.00	.83	10.660 120	15 14 08
19	19 04 55.040	+22 26 00.14	6.99	.82	10.672 598	15 10 35
20	19 05 18.764	+22 25 28.35	6.98	.82	10.684 898	15 07 03
21	19 05 42.743	+22 24 55.93	6.97	0.82	10.697 015	15 03 31
22	19 06 06.970	+22 24 22.89	6.96	.82	10.708 947	14 59 59
23	19 06 31.438	+22 23 49.23	6.96	.82	10.720 692	14 56 28
24	19 06 56.141	+22 23 14.95	6.95	.82	10.732 245	14 52 57
25	19 07 21.073	+22 22 40.05	6.94	.82	10.743 604	14 49 26
26	19 07 46.227	+22 22 04.51	6.93	0.82	10.754 767	14 45 55
27	19 08 11.600	+22 21 28.34	6.93	.82	10.765 731	14 42 25
28	19 08 37.189	+22 20 51.53	6.92	.82	10.776 493	14 38 54
29	19 09 02.988	+22 20 14.07	6.91	.82	10.787 053	14 35 24
30	19 09 28.996	+22 19 35.97	6.91	.82	10.797 406	14 31 54
Dec. 1	19 09 55.207	+22 18 57.24	6.90	0.81	10.807 552	14 28 25
2	19 10 21.617	+22 18 17.87	6.89	.81	10.817 488	14 24 55
3	19 10 48.223	+22 17 37.88	6.89	.81	10.827 212	14 21 26
4	19 11 15.018	+22 16 57.28	6.88	.81	10.836 721	14 17 57
5	19 11 41.997	+22 16 16.07	6.88	.81	10.846 014	14 14 28
6	19 12 09.155	+22 15 34.25	6.87	0.81	10.855 088	14 10 59
7	19 12 36.487	+22 14 51.83	6.86	.81	10.863 942	14 07 30
8	19 13 03.988	+22 14 08.81	6.86	.81	10.872 572	14 04 02
9	19 13 31.653	+22 13 25.18	6.85	.81	10.880 977	14 00 33
10	19 13 59.477	+22 12 40.96	6.85	.81	10.889 155	13 57 05
11	19 14 27.455	+22 11 56.13	6.84	0.81	10.897 103	13 53 37
12	19 14 55.584	+22 11 10.69	6.84	.81	10.904 819	13 50 09
13	19 15 23.859	+22 10 24.66	6.83	.81	10.912 302	13 46 42
14	19 15 52.277	+22 09 38.01	6.83	.81	10.919 549	13 43 14
15	19 16 20.834	+22 08 50.78	6.82	.81	10.926 558	13 39 47
16	19 16 49.526	+22 08 02.94	6.82	0.80	10.933 327	13 36 19
17	19 17 18.348	+22 07 14.54	6.82	.80	10.939 854	13 32 52
18	19 17 47.296	+22 06 25.56	6.81	.80	10.946 137	13 29 25
19	19 18 16.361	+22 05 36.04	6.81	.80	10.952 174	13 25 58
20	19 18 45.537	+22 04 45.98	6.81	.80	10.957 963	13 22 31
21	19 19 14.817	+22 03 55.40	6.80	0.80	10.963 504	13 19 05
22	19 19 44.192	+22 03 04.30	6.80	.80	10.968 795	13 15 38
23	19 20 13.658	+22 02 12.66	6.80	.80	10.973 834	13 12 12
24	19 20 43.209	+22 01 20.50	6.79	.80	10.978 621	13 08 45
25	19 21 12.842	+22 00 27.80	6.79	.80	10.983 156	13 05 19
26	19 21 42.552	+21 59 34.58	6.79	0.80	10.987 437	13 01 52
27	19 22 12.335	+21 58 40.84	6.78	.80	10.991 464	12 58 26
28	19 22 42.188	+21 57 46.59	6.78	.80	10.995 236	12 55 00
29	19 23 12.106	+21 56 51.84	6.78	.80	10.998 753	12 51 34
30	19 23 42.083	+21 55 56.61	6.78	.80	11.002 014	12 48 08
31	19 24 12.117	+21 55 00.90	6.78	0.80	11.005 019	12 44 42
32	19 24 42.199	+21 54 04.73	6.77	0.80	11.007 766	12 41 16

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	9 32 49.451 - 6.840	+15 19 35.08 +35.36	1.94	0.50	17.66288 -1154	2 57 38
1	9 32 42.611 7.007	15 20 10.44 36.13	.94	.50	.65134 1129	2 53 35
2	9 32 35.604 7.172	15 20 46.57 36.87	.94	.50	.64005 1106	2 49 32
3	9 32 28.432 7.333	15 21 23.44 37.57	.94	.50	.62899 1081	2 45 29
4	9 32 21.099 7.487	15 22 01.01 38.27	.95	.50	.61818 1057	2 41 26
5	9 32 13.612 - 7.638	+15 22 39.28 +38.94	1.95	0.50	17.60761 -1031	2 37 22
6	9 32 05.974 7.785	15 23 18.22 39.58	.95	.50	.59730 1006	2 33 19
7	9 31 58.189 7.927	15 23 57.80 40.21	.95	.50	.58724 981	2 29 15
8	9 31 50.262 8.065	15 24 38.01 40.83	.95	.50	.57743 954	2 25 11
9	9 31 42.197 8.199	15 25 18.84 41.41	.95	.50	.56789 928	2 21 07
10	9 31 33.998 - 8.332	+15 26 00.25 +41.99	1.95	0.50	17.55861 -901	2 17 03
11	9 31 25.666 8.459	15 26 42.24 42.56	.95	.50	.54960 874	2 12 59
12	9 31 17.207 8.585	15 27 24.80 43.10	.95	.50	.54086 848	2 08 55
13	9 31 08.622 8.706	15 28 07.90 43.64	.96	.50	.53238 819	2 04 50
14	9 30 59.916 8.826	15 28 51.54 44.15	.96	.50	.52419 792	2 00 46
15	9 30 51.090 - 8.941	+15 29 35.69 +44.65	1.96	0.50	17.51627 -764	1 56 41
16	9 30 42.149 9.055	15 30 20.34 45.12	.96	.50	.50863 736	1 52 36
17	9 30 33.094 9.163	15 31 05.46 45.57	.96	.50	.50127 707	1 48 31
18	9 30 23.931 9.267	15 31 51.03 46.00	.96	.50	.49420 679	1 44 26
19	9 30 14.664 9.367	15 32 37.03 46.39	.96	.50	.48741 649	1 40 21
20	9 30 05.297 - 9.462	+15 33 23.42 +46.76	1.96	0.50	17.48092 -621	1 36 16
21	9 29 55.835 9.551	15 34 10.18 47.11	.96	.50	.47471 591	1 32 11
22	9 29 46.284 9.636	15 34 57.29 47.43	.96	.50	.46880 561	1 28 05
23	9 29 36.648 9.715	15 35 44.72 47.73	.96	.50	.46319 532	1 24 00
24	9 29 26.933 9.790	15 36 32.45 48.01	.96	.50	.45787 501	1 19 54
25	9 29 17.143 - 9.862	+15 37 20.46 +48.29	1.96	0.50	17.45286 -471	1 15 49
26	9 29 07.281 9.930	15 38 08.75 48.55	.96	.50	.44815 440	1 11 43
27	9 28 57.351 9.997	15 38 57.30 48.79	.97	.50	.44375 410	1 07 37
28	9 28 47.354 10.057	15 39 46.09 49.01	.97	.50	.43965 379	1 03 31
29	9 28 37.297 10.115	15 40 35.10 49.19	.97	.50	.43586 348	0 59 25
30	9 28 27.182 - 10.167	+15 41 24.29 +49.35	1.97	0.50	17.43238 -317	0 55 19
31	9 28 17.015 10.212	15 42 13.64 49.47	.97	.50	.42921 285	0 51 13
Feb. 1	9 28 06.803 10.253	15 43 03.11 49.57	.97	.50	.42636 255	0 47 07
2	9 27 56.550 10.286	15 43 52.68 49.63	.97	.51	.42381 223	0 43 01
3	9 27 46.264 10.314	15 44 42.31 49.68	.97	.51	.42158 192	0 38 55
4	9 27 35.950 - 10.337	+15 45 31.99 +49.70	1.97	0.51	17.41966 -161	0 34 49
5	9 27 25.613 10.356	15 46 21.69 49.71	.97	.51	.41805 129	0 30 43
6	9 27 15.257 10.369	15 47 11.40 49.69	.97	.51	.41676 98	0 26 36
7	9 27 04.888 10.378	15 48 01.09 49.65	.97	.51	.41578 67	0 22 30
8	9 26 54.510 10.384	15 48 50.74 49.61	.97	.51	.41511 36	0 18 24
9	9 26 44.126 - 10.386	+15 49 40.35 +49.53	1.97	0.51	17.41475 -4	0 14 18
10	9 26 33.740 10.384	15 50 29.88 49.45	.97	.51	.41471 + 27	0 10 11
11	9 26 23.356 10.376	15 51 19.33 49.33	.97	.51	.41498 58	0 06 05
12	9 26 12.980 10.367	15 52 08.66 49.21	.97	.51	.41556 89	{ 0 01 59 }
13	9 26 02.613 10.352	15 52 57.87 49.04	.97	.51	.41645 120	23 57 53
14	9 25 52.261 - 10.332	+15 53 46.91 +48.87	1.97	0.51	17.41765 + 151	23 49 40
15	9 25 41.929	+15 54 35.78	1.97	0.51	17.41916	23 45 34

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	9 25 41.929 ^s	+15 54 35.78	1.97	0.51	17.41916	23 45 34
16	9 25 31.620 ^{-10.309}	15 55 24.43 ^{+48.65}	.97	.51	.42098 ⁺¹⁸²	23 41 28
17	9 25 21.341 ^{10.279}	15 56 12.85 ^{48.42}	.97	.51	.42311 ²¹³	23 37 22
18	9 25 11.099 ^{10.242}	15 57 01.00 ^{48.15}	.97	.51	.42554 ²⁴³	23 33 16
19	9 25 00.897 ^{10.202}	15 57 48.87 ^{47.87}	.97	.50	.42829 ²⁷⁵	23 29 10
						305
20	9 24 50.741 ^{10.156}	+15 58 36.44 ^{47.57}	1.97	0.50	17.43134	23 25 04
21	9 24 40.636 ^{-10.105}	15 59 23.69 ^{+47.25}	.97	.50	.43469 ⁺³³⁵	23 20 58
22	9 24 30.585 ^{10.051}	16 00 10.60 ^{46.91}	.97	.50	.43835 ³⁶⁶	23 16 52
23	9 24 20.593 ^{9.992}	16 00 57.17 ^{46.57}	.97	.50	.44231 ³⁹⁶	23 12 46
24	9 24 10.661 ^{9.932}	16 01 43.38 ^{46.21}	.96	.50	.44658 ⁴²⁷	23 08 41
						456
25	9 24 00.794 ^{9.867}	+16 02 29.22 ^{45.84}	1.96	0.50	17.45114	23 04 35
26	9 23 50.995 ^{-9.799}	16 03 14.65 ^{+45.43}	.96	.50	.45601 ⁺⁴⁸⁷	23 00 30
27	9 23 41.270 ^{9.725}	16 03 59.65 ^{45.00}	.96	.50	.46117 ⁵¹⁶	22 56 24
28	9 23 31.625 ^{9.645}	16 04 44.19 ^{44.54}	.96	.50	.46662 ⁵⁴⁵	22 52 19
29	9 23 22.063 ^{9.562}	16 05 28.26 ^{44.07}	.96	.50	.47237 ⁵⁷⁵	22 48 13
						604
Mar. 1	9 23 12.591 ^{9.472}	+16 06 11.81 ^{43.55}	1.96	0.50	17.47841	22 44 08
2	9 23 03.215 ^{-9.376}	16 06 54.83 ^{+43.02}	.96	.50	.48473 ⁺⁶³²	22 40 03
3	9 22 53.939 ^{9.276}	16 07 37.31 ^{42.48}	.96	.50	.49134 ⁶⁶¹	22 35 58
4	9 22 44.768 ^{9.171}	16 08 19.23 ^{41.92}	.96	.50	.49823 ⁶⁸⁹	22 31 53
5	9 22 35.705 ^{9.063}	16 09 00.58 ^{41.35}	.96	.50	.50540 ⁷¹⁷	22 27 48
						744
6	9 22 26.754 ^{8.951}	+16 09 41.34 ^{40.76}	1.96	0.50	17.51284	22 23 43
7	9 22 17.918 ^{-8.836}	16 10 21.50 ^{+40.16}	.96	.50	.52056 ⁺⁷⁷²	22 19 39
8	9 22 09.200 ^{8.718}	16 11 01.06 ^{39.56}	.96	.50	.52854 ⁷⁹⁸	22 15 34
9	9 22 00.603 ^{8.597}	16 11 40.00 ^{38.94}	.95	.50	.53679 ⁸²⁵	22 11 30
10	9 21 52.131 ^{8.472}	16 12 18.30 ^{38.30}	.95	.50	.54531 ⁸⁵²	22 07 26
						877
11	9 21 43.785 ^{8.346}	+16 12 55.95 ^{37.65}	1.95	0.50	17.55408	22 03 22
12	9 21 35.569 ^{-8.216}	16 13 32.93 ^{+36.98}	.95	.50	.56311 ⁺⁹⁰³	21 59 18
13	9 21 27.487 ^{8.082}	16 14 09.23 ^{36.30}	.95	.50	.57239 ⁹²⁸	21 55 14
14	9 21 19.542 ^{7.945}	16 14 44.82 ^{35.59}	.95	.50	.58192 ⁹⁵³	21 51 10
15	9 21 11.738 ^{7.804}	16 15 19.69 ^{34.87}	.95	.50	.59170 ⁹⁷⁸	21 47 07
						1002
16	9 21 04.079 ^{7.659}	+16 15 53.82 ^{34.13}	1.95	0.50	17.60172	21 43 03
17	9 20 56.570 ^{-7.509}	16 16 27.19 ^{+33.37}	.95	.50	.61198 ⁺¹⁰²⁶	21 39 00
18	9 20 49.214 ^{7.356}	16 16 59.79 ^{32.60}	.95	.50	.62248 ¹⁰⁵⁰	21 34 57
19	9 20 42.016 ^{7.198}	16 17 31.62 ^{31.83}	.94	.50	.63322 ¹⁰⁷⁴	21 30 54
20	9 20 34.976 ^{7.040}	16 18 02.67 ^{31.05}	.94	.50	.64418 ¹⁰⁹⁶	21 26 51
						1119
21	9 20 28.097 ^{6.879}	+16 18 32.93 ^{30.26}	1.94	0.50	17.65537	21 22 49
22	9 20 21.380 ^{-6.717}	16 19 02.40 ^{+29.47}	.94	.50	.66678 ⁺¹¹⁴¹	21 18 46
23	9 20 14.828 ^{6.552}	16 19 31.07 ^{28.67}	.94	.50	.67841 ¹¹⁶³	21 14 44
24	9 20 08.443 ^{6.385}	16 19 58.93 ^{27.86}	.94	.50	.69026 ¹¹⁸⁵	21 10 42
25	9 20 02.227 ^{6.216}	16 20 25.96 ^{27.03}	.94	.50	.70231 ¹²⁰⁵	21 06 40
						1227
26	9 19 56.185 ^{6.042}	+16 20 52.15 ^{26.19}	1.94	0.50	17.71458	21 02 38
27	9 19 50.319 ^{-5.866}	16 21 17.46 ^{+25.31}	.93	.50	.72705 ⁺¹²⁴⁷	20 58 37
28	9 19 44.633 ^{5.686}	16 21 41.90 ^{24.44}	.93	.50	.73971 ¹²⁶⁶	20 54 35
29	9 19 39.131 ^{5.502}	16 22 05.45 ^{23.55}	.93	.50	.75257 ¹²⁸⁶	20 50 34
30	9 19 33.815 ^{5.316}	16 22 28.10 ^{22.65}	.93	.50	.76562 ¹³⁰⁵	20 46 33
						1323
31	9 19 28.690 ^{5.125}	+16 22 49.83 ^{21.73}	1.93	0.49	17.77885	20 42 32
Apr. 1	9 19 23.756 ^{-4.934}	+16 23 10.65 ^{+20.82}	1.93	0.49	17.79226 ⁺¹³⁴¹	20 38 32

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	9 19 23.756 - 4.741	+16 23 10.65 +19.92	1.93	0.49	17.79226 +1359	20 38 32
2	9 19 19.015 4.547	16 23 30.57 18.99	.93	.49	.80585 1375	20 34 31
3	9 19 14.468 4.352	16 23 49.56 18.08	.92	.49	.81960 1392	20 30 31
4	9 19 10.116 4.155	16 24 07.64 17.17	.92	.49	.83352 1408	20 26 31
5	9 19 05.961 3.958	16 24 24.81 16.23	.92	.49	.84760 1424	20 22 31
6	9 19 02.003 - 3.759	+16 24 41.04 +15.31	1.92	0.49	17.86184 +1438	20 18 31
7	9 18 58.244 3.561	16 24 56.35 14.38	.92	.49	.87622 1453	20 14 32
8	9 18 54.683 3.361	16 25 10.73 13.43	.92	.49	.89075 1468	20 10 32
9	9 18 51.322 3.160	16 25 24.16 12.48	.91	.49	.90543 1481	20 06 33
10	9 18 48.162 2.956	16 25 36.64 11.52	.91	.49	.92024 1494	20 02 34
11	9 18 45.206 - 2.751	+16 25 48.16 +10.54	1.91	0.49	17.93518 +1507	19 58 36
12	9 18 42.455 2.543	16 25 58.70 9.56	.91	.49	.95025 1519	19 54 37
13	9 18 39.912 2.334	16 26 08.26 8.59	.91	.49	.96544 1531	19 50 39
14	9 18 37.578 2.123	16 26 16.85 7.61	.91	.49	.98075 1543	19 46 41
15	9 18 35.455 1.911	16 26 24.46 6.62	.90	.49	17.99618 1553	19 42 43
16	9 18 33.544 - 1.701	+16 26 31.08 + 5.66	1.90	0.49	18.01171 +1564	19 38 45
17	9 18 31.843 1.492	16 26 36.74 4.70	.90	.49	.02735 1574	19 34 48
18	9 18 30.351 1.281	16 26 41.44 3.73	.90	.49	.04309 1584	19 30 51
19	9 18 29.070 1.072	16 26 45.17 2.77	.90	.49	.05893 1593	19 26 54
20	9 18 27.998 0.860	16 26 47.94 1.79	.90	.49	.07486 1601	19 22 57
21	9 18 27.138 - 0.650	+16 26 49.73 + 0.81	1.89	0.49	18.09087 +1610	19 19 00
22	9 18 26.488 0.436	16 26 50.54 - 0.19	.89	.49	.10697 1618	19 15 04
23	9 18 26.052 0.222	16 26 50.35 1.18	.89	.49	.12315 1624	19 11 08
24	9 18 25.830 - 0.006	16 26 49.17 2.18	.89	.49	.13939 1631	19 07 12
25	9 18 25.824 + 0.211	16 26 46.99 3.20	.89	.48	.15570 1638	19 03 16
26	9 18 26.035 + 0.428	+16 26 43.79 - 4.19	1.89	0.48	18.17208 +1643	18 59 21
27	9 18 26.463 0.647	16 26 39.60 5.19	.88	.48	.18851 1648	18 55 25
28	9 18 27.110 0.864	16 26 34.41 6.18	.88	.48	.20499 1652	18 51 30
29	9 18 27.974 1.081	16 26 28.23 7.16	.88	.48	.22151 1657	18 47 35
30	9 18 29.055 1.296	16 26 21.07 8.15	.88	.48	.23808 1660	18 43 41
May 1	9 18 30.351 + 1.511	+16 26 12.92 - 9.13	1.88	0.48	18.25468 +1663	18 39 46
2	9 18 31.862 1.724	16 26 03.79 10.08	.88	.48	.27131 1666	18 35 52
3	9 18 33.586 1.937	16 25 53.71 11.06	.87	.48	.28797 1668	18 31 58
4	9 18 35.523 2.148	16 25 42.65 12.02	.87	.48	.30465 1669	18 28 04
5	9 18 37.671 2.359	16 25 30.63 12.99	.87	.48	.32134 1670	18 24 11
6	9 18 40.030 + 2.569	+16 25 17.64 -13.95	1.87	0.48	18.33804 +1671	18 20 17
7	9 18 42.599 2.778	16 25 03.69 14.93	.87	.48	.35475 1671	18 16 24
8	9 18 45.377 2.988	16 24 48.76 15.88	.87	.48	.37146 1671	18 12 31
9	9 18 48.365 3.198	16 24 32.88 16.87	.86	.48	.38817 1670	18 08 38
10	9 18 51.563 3.408	16 24 16.01 17.83	.86	.48	.40487 1669	18 04 46
11	9 18 54.971 + 3.618	+16 23 58.18 -18.80	1.86	0.48	18.42156 +1667	18 00 53
12	9 18 58.589 3.827	16 23 39.38 19.74	.86	.48	.43823 1666	17 57 01
13	9 19 02.416 4.035	16 23 19.64 20.69	.86	.48	.45489 1662	17 53 09
14	9 19 06.451 4.238	16 22 58.95 21.61	.86	.48	.47151 1660	17 49 17
15	9 19 10.689 4.441	16 22 37.34 22.52	.85	.48	.48811 1657	17 45 26
16	9 19 15.130 + 4.641	+16 22 14.82 -23.44	1.85	0.48	18.50468 +1653	17 41 35
17	9 19 19.771	+16 21 51.38	1.85	0.48	18.52121	17 37 43

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	9 19 19.771 + 4.840	+16 21 51.38 -24.36	1.85	0.48	18.52121 +1649	17 37 43
18	9 19 24.611 + 5.038	16 21 27.02 25.26	.85	.47	.53770 1644	17 33 52
19	9 19 29.649 + 5.238	16 21 01.76 26.19	.85	.47	.55414 1639	17 30 02
20	9 19 34.887 + 5.435	16 20 35.57 27.10	.85	.47	.57053 1633	17 26 11
21	9 19 40.322 + 5.633	16 20 08.47 28.03	.84	.47	.58686 1628	17 22 21
22	9 19 45.955 + 5.831	+16 19 40.44 -28.94	1.84	0.47	18.60314 +1621	17 18 31
23	9 19 51.786 + 6.029	16 19 11.50 29.85	.84	.47	.61935 1614	17 14 41
24	9 19 57.815 + 6.224	16 18 41.65 30.75	.84	.47	.63549 1606	17 10 51
25	9 20 04.039 + 6.418	16 18 10.90 31.64	.84	.47	.65155 1599	17 07 01
26	9 20 10.457 + 6.610	16 17 39.26 32.51	.84	.47	.66754 1590	17 03 12
27	9 20 17.067 + 6.800	+16 17 06.75 -33.38	1.83	0.47	18.68344 +1582	16 59 23
28	9 20 23.867 + 6.987	16 16 33.37 34.24	.83	.47	.69926 1573	16 55 34
29	9 20 30.854 + 7.173	16 15 59.13 35.08	.83	.47	.71499 1562	16 51 45
30	9 20 38.027 + 7.354	16 15 24.05 35.92	.83	.47	.73061 1553	16 47 56
31	9 20 45.381 + 7.535	16 14 48.13 36.74	.83	.47	.74614 1543	16 44 08
June 1	9 20 52.916 + 7.713	+16 14 11.39 -37.57	1.83	0.47	18.76157 +1531	16 40 19
2	9 21 00.629 + 7.889	16 13 33.82 38.39	.83	.47	.77688 1520	16 36 31
3	9 21 08.518 + 8.063	16 12 55.43 39.21	.82	.47	.79208 1509	16 32 43
4	9 21 16.581 + 8.236	16 12 16.22 40.03	.82	.47	.80717 1497	16 28 56
5	9 21 24.817 + 8.408	16 11 36.19 40.83	.82	.47	.82214 1484	16 25 08
6	9 21 33.225 + 8.580	+16 10 55.36 -41.64	1.82	0.47	18.83698 +1471	16 21 21
7	9 21 41.805 + 8.749	16 10 13.72 42.45	.82	.47	.85169 1459	16 17 33
8	9 21 50.554 + 8.918	16 09 31.27 43.23	.82	.47	.86628 1445	16 13 46
9	9 21 59.472 + 9.085	16 08 48.04 44.00	.82	.47	.88073 1431	16 09 59
10	9 22 08.557 + 9.247	16 08 04.04 44.75	.81	.47	.89504 1418	16 06 12
11	9 22 17.804 + 9.406	+16 07 19.29 -45.48	1.81	0.47	18.90922 +1403	16 02 26
12	9 22 27.210 + 9.561	16 06 33.81 46.21	.81	.47	.92325 1389	15 58 39
13	9 22 36.771 + 9.714	16 05 47.60 46.93	.81	.46	.93714 1373	15 54 53
14	9 22 46.485 + 9.866	16 05 00.67 47.65	.81	.46	.95087 1358	15 51 07
15	9 22 56.351 + 10.016	16 04 13.02 48.36	.81	.46	.96445 1343	15 47 21
16	9 23 06.367 + 10.165	+16 03 24.66 -49.09	1.81	0.46	18.97788 +1326	15 43 35
17	9 23 16.532 + 10.315	16 02 35.57 49.80	.81	.46	18.99114 1310	15 39 49
18	9 23 26.847 + 10.461	16 01 45.77 50.51	.80	.46	19.00424 1294	15 36 04
19	9 23 37.308 + 10.607	16 00 55.26 51.21	.80	.46	.01718 1276	15 32 18
20	9 23 47.915 + 10.752	16 00 04.05 51.89	.80	.46	.02994 1259	15 28 33
21	9 23 58.667 + 10.892	+15 59 12.16 -52.56	1.80	0.46	19.04253 +1241	15 24 48
22	9 24 09.559 + 11.032	15 58 19.60 53.23	.80	.46	.05494 1223	15 21 03
23	9 24 20.591 + 11.168	15 57 26.37 53.87	.80	.46	.06717 1204	15 17 18
24	9 24 31.759 + 11.300	15 56 32.50 54.50	.80	.46	.07921 1186	15 13 34
25	9 24 43.059 + 11.431	15 55 38.00 55.11	.80	.46	.09107 1166	15 09 49
26	9 24 54.490 + 11.556	+15 54 42.89 -55.72	1.79	0.46	19.10273 +1148	15 06 05
27	9 25 06.046 + 11.681	15 53 47.17 56.32	.79	.46	.11421 1127	15 02 20
28	9 25 17.727 + 11.801	15 52 50.85 56.89	.79	.46	.12548 1108	14 58 36
29	9 25 29.528 + 11.919	15 51 53.96 57.48	.79	.46	.13656 1087	14 54 52
30	9 25 41.447 + 12.035	15 50 56.48 58.05	.79	.46	.14743 1067	14 51 08
July 1	9 25 53.482 + 12.148	+15 49 58.43 -58.61	1.79	0.46	19.15810 +1046	14 47 24
2	9 26 05.630	+15 48 59.82	1.79	0.46	19.16856	14 43 40

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July	1 9 25 53.482 ^s	+15 49 58.43	1.79	0.46	19.15810	14 47 24
	2 9 26 05.630 ^{+12.148}	15 48 59.82 ^{-58.61}	.79	.46	.16856 ⁺¹⁰⁴⁶	14 43 40
	3 9 26 17.891 ^{12.261}	15 48 00.64 ^{59.18}	.79	.46	.17882 ¹⁰²⁶	14 39 57
	4 9 26 30.262 ^{12.371}	15 47 00.91 ^{59.73}	.79	.46	.18886 ¹⁰⁰⁴	14 36 13
	5 9 26 42.742 ^{12.480}	15 46 00.64 ^{60.27}	.79	.46	.19868 ⁹⁸²	14 32 30
	6 9 26 55.328 ^{12.586}	+15 44 59.83 ^{60.81}	1.78	0.46	19.20830	14 28 46
	7 9 27 08.020 ^{+12.692}	15 43 58.51 ^{-61.32}	.78	.46	.21769 ⁺⁹³⁹	14 25 03
	8 9 27 20.813 ^{12.793}	15 42 56.69 ^{61.82}	.78	.46	.22686 ⁹¹⁷	14 21 20
	9 9 27 33.702 ^{12.889}	15 41 54.41 ^{62.28}	.78	.46	.23581 ⁸⁹⁵	14 17 37
	10 9 27 46.684 ^{12.982}	15 40 51.67 ^{62.74}	.78	.46	.24454 ⁸⁷³	14 13 54
	11 9 27 59.757 ^{13.073}	+15 39 48.49 ^{63.18}	1.78	0.46	19.25305	14 10 11
	12 9 28 12.915 ^{+13.158}	15 38 44.86 ^{-63.63}	.78	.46	.26133 ⁺⁸²⁸	14 06 28
	13 9 28 26.158 ^{13.243}	15 37 40.79 ^{64.07}	.78	.46	.26937 ⁸⁰⁴	14 02 46
	14 9 28 39.486 ^{13.328}	15 36 36.28 ^{64.51}	.78	.46	.27719 ⁷⁸²	13 59 03
	15 9 28 52.896 ^{13.410}	15 35 31.34 ^{64.94}	.78	.46	.28477 ⁷⁵⁸	13 55 20
	16 9 29 06.387 ^{13.491}	+15 34 25.97 ^{65.37}	1.78	0.46	19.29212	13 51 38
	17 9 29 19.958 ^{+13.571}	15 33 20.19 ^{-65.78}	.78	.46	.29923 ⁺⁷¹¹	13 47 56
	18 9 29 33.607 ^{13.649}	15 32 14.01 ^{66.18}	.78	.46	.30610 ⁶⁸⁷	13 44 13
	19 9 29 47.330 ^{13.723}	15 31 07.45 ^{66.56}	.77	.46	.31272 ⁶⁶²	13 40 31
	20 9 30 01.125 ^{13.795}	15 30 00.51 ^{66.94}	.77	.46	.31910 ⁶³⁸	13 36 49
	21 9 30 14.989 ^{13.864}	+15 28 53.22 ^{67.29}	1.77	0.46	19.32524	13 33 07
	22 9 30 28.918 ^{+13.929}	15 27 45.60 ^{-67.62}	.77	.46	.33113 ⁺⁵⁸⁹	13 29 25
	23 9 30 42.909 ^{13.991}	15 26 37.66 ^{67.94}	.77	.46	.33677 ⁵⁶⁴	13 25 43
	24 9 30 56.959 ^{14.050}	15 25 29.41 ^{68.25}	.77	.45	.34216 ⁵³⁹	13 22 01
	25 9 31 11.063 ^{14.104}	15 24 20.87 ^{68.54}	.77	.45	.34730 ⁵¹⁴	13 18 19
	26 9 31 25.220 ^{14.157}	+15 23 12.05 ^{68.82}	1.77	0.45	19.35218	13 14 37
	27 9 31 39.425 ^{+14.205}	15 22 02.96 ^{-69.09}	.77	.45	.35681 ⁺⁴⁶³	13 10 56
	28 9 31 53.677 ^{14.252}	15 20 53.61 ^{69.35}	.77	.45	.36118 ⁴³⁷	13 07 14
	29 9 32 07.972 ^{14.295}	15 19 44.01 ^{69.60}	.77	.45	.36529 ⁴¹¹	13 03 32
	30 9 32 22.309 ^{14.337}	15 18 34.16 ^{69.85}	.77	.45	.36915 ³⁸⁶	12 59 51
	31 9 32 36.687 ^{14.378}	+15 17 24.07 ^{70.09}	1.77	0.45	19.37274	12 56 09
Aug.	1 9 32 51.103 ^{+14.416}	15 16 13.76 ^{-70.31}	.77	.45	.37608 ⁺³³⁴	12 52 28
	2 9 33 05.555 ^{14.452}	15 15 03.23 ^{70.53}	.77	.45	.37916 ³⁰⁸	12 48 46
	3 9 33 20.040 ^{14.485}	15 13 52.51 ^{70.72}	.77	.45	.38198 ²⁸²	12 45 04
	4 9 33 34.557 ^{14.517}	15 12 41.62 ^{70.89}	.77	.45	.38453 ²⁵⁵	12 41 23
	5 9 33 49.099 ^{14.542}	+15 11 30.56 ^{71.06}	1.77	0.45	19.38683	12 37 42
	6 9 34 03.664 ^{+14.565}	15 10 19.38 ^{-71.18}	.77	.45	.38886 ⁺²⁰³	12 34 00
	7 9 34 18.248 ^{14.584}	15 09 08.08 ^{71.30}	.77	.45	.39063 ¹⁷⁷	12 30 19
	8 9 34 32.846 ^{14.598}	15 07 56.68 ^{71.40}	.77	.45	.39214 ¹⁵¹	12 26 37
	9 9 34 47.457 ^{14.611}	15 06 45.18 ^{71.50}	.77	.45	.39339 ¹²⁵	12 22 56
	10 9 35 02.080 ^{14.623}	+15 05 33.57 ^{71.61}	1.77	0.45	19.39437	12 19 15
	11 9 35 16.712 ^{+14.632}	15 04 21.87 ^{-71.70}	.77	.45	.39509 ⁺⁷²	12 15 33
	12 9 35 31.353 ^{14.641}	15 03 10.08 ^{71.79}	.77	.45	.39555 ⁴⁶	12 11 52
	13 9 35 46.001 ^{14.648}	15 01 58.22 ^{71.86}	.77	.45	.39574 ⁺¹⁹	12 08 11
	14 9 36 00.654 ^{14.653}	15 00 46.30 ^{71.92}	.77	.45	.39566 ⁻⁸	12 04 29
	15 9 36 15.309 ^{14.655}	+14 59 34.34 ^{71.96}	1.77	0.45	19.39532	12 00 48
	16 9 36 29.963 ^{+14.654}	+14 58 22.35 ^{-71.99}	1.77	0.45	19.39471	11 57 07

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	9 36 29.963 ^s	+14 58 22.35 ["]	1.77	0.45	19.39471 - 88	11 57 07
17	9 36 44.614 +14.651	14 57 10.35 -72.00	.77	.45	.39383 114	11 53 25
18	9 36 59.257 14.643	14 55 58.36 71.99	.77	.45	.39269 141	11 49 44
19	9 37 13.889 14.632	14 54 46.41 71.95	.77	.45	.39128 168	11 46 03
20	9 37 28.507 14.618	14 53 34.51 71.90	.77	.45	.38960 195	11 42 21
21	9 37 43.107 14.600	+14 52 22.66 -71.77	1.77	0.45	19.38765 - 221	11 38 40
22	9 37 57.686 +14.579	14 51 10.89 71.69	.77	.45	.38544 248	11 34 58
23	9 38 12.240 14.554	14 49 59.20 71.58	.77	.45	.38296 274	11 31 17
24	9 38 26.767 14.527	14 48 47.62 71.47	.77	.45	.38022 302	11 27 36
25	9 38 41.264 14.497	14 47 36.15 71.36	.77	.45	.37720 327	11 23 54
26	9 38 55.730 +14.466	+14 46 24.79 -71.24	1.77	0.45	19.37393 - 354	11 20 13
27	9 39 10.162 14.432	14 45 13.55 71.09	.77	.45	.37039 381	11 16 31
28	9 39 24.558 14.396	14 44 02.46 70.93	.77	.45	.36658 407	11 12 49
29	9 39 38.916 14.358	14 42 51.53 70.78	.77	.45	.36251 433	11 09 08
30	9 39 53.235 14.319	14 41 40.75 70.57	.77	.45	.35818 458	11 05 26
31	9 40 07.510 14.275	+14 40 30.18 -70.37	1.77	0.45	19.35360 - 485	11 01 44
Sept. 1	9 40 21.737 +14.227	14 39 19.81 70.12	.77	.45	.34875 511	10 58 02
2	9 40 35.915 14.178	14 38 09.69 69.87	.77	.45	.34364 536	10 54 21
3	9 40 50.037 14.122	14 36 59.82 69.61	.77	.46	.33828 561	10 50 39
4	9 41 04.101 14.064	14 35 50.21 69.32	.77	.46	.33267 587	10 46 57
5	9 41 18.103 14.002	+14 34 40.89 -69.04	1.77	0.46	19.32680 - 612	10 43 15
6	9 41 32.043 +13.940	14 33 31.85 68.76	.77	.46	.32068 637	10 39 33
7	9 41 45.918 13.875	14 32 23.09 68.47	.77	.46	.31431 663	10 35 51
8	9 41 59.727 13.809	14 31 14.62 68.15	.78	.46	.30768 687	10 32 08
9	9 42 13.469 13.742	14 30 06.47 67.84	.78	.46	.30081 712	10 28 26
10	9 42 27.143 +13.674	+14 28 58.63 -67.50	1.78	0.46	19.29369 - 737	10 24 44
11	9 42 40.745 13.528	14 27 51.13 67.15	.78	.46	.28632 761	10 21 01
12	9 42 54.273 13.450	14 26 43.98 66.77	.78	.46	.27871 786	10 17 19
13	9 43 07.723 13.450	14 25 37.21 66.38	.78	.46	.27085 810	10 13 36
14	9 43 21.093 13.370	14 24 30.83 65.96	.78	.46	.26275 834	10 09 54
15	9 43 34.379 +13.286	+14 23 24.87 -65.53	1.78	0.46	19.25441 - 858	10 06 11
16	9 43 47.578 13.199	14 22 19.34 65.09	.78	.46	.24583 882	10 02 28
17	9 44 00.685 13.107	14 21 14.25 64.63	.78	.46	.23701 905	9 58 45
18	9 44 13.698 13.013	14 20 09.62 64.15	.78	.46	.22796 929	9 55 02
19	9 44 26.614 12.916	14 19 05.47 63.66	.78	.46	.21867 953	9 51 19
20	9 44 39.429 +12.815	+14 18 01.81 -63.16	1.78	0.46	19.20914 - 975	9 47 36
21	9 44 52.143 12.714	14 16 58.65 62.66	.79	.46	.19939 998	9 43 53
22	9 45 04.751 12.608	14 15 55.99 62.14	.79	.46	.18941 1020	9 40 09
23	9 45 17.253 12.502	14 14 53.85 61.62	.79	.46	.17921 1043	9 36 26
24	9 45 29.647 12.394	14 13 52.23 61.07	.79	.46	.16878 1065	9 32 42
25	9 45 41.930 +12.283	+14 12 51.16 -60.51	1.79	0.46	19.15813 - 1086	9 28 58
26	9 45 54.102 12.172	14 11 50.65 59.93	.79	.46	.14727 1108	9 25 15
27	9 46 06.158 12.056	14 10 50.72 59.34	.79	.46	.13619 1129	9 21 31
28	9 46 18.096 11.938	14 09 51.38 58.71	.79	.46	.12490 1149	9 17 47
29	9 46 29.911 11.815	14 08 52.67 58.07	.79	.46	.11341 1170	9 14 02
30	9 46 41.600 11.689	+14 07 54.60 -57.42	1.79	0.46	19.10171 - 1191	9 10 18
Oct. 1	9 46 53.161 +11.561	+14 06 57.18	1.80	0.46	19.08980	9 06 34

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct.	1 9 46 53.161 ^s +11.427	+14 06 57.18 ["] -56.75	1.80	0.46	19.08980 -1210	9 06 34
	2 9 47 04.588 11.295	14 06 00.43 56.07	.80	.46	.07770 1229	9 02 49
	3 9 47 15.883 11.159	14 05 04.36 55.41	.80	.46	.06541 1250	8 59 04
	4 9 47 27.042 11.022	14 04 08.95 54.72	.80	.46	.05291 1268	8 55 19
	5 9 47 38.064 10.886	14 03 14.23 54.03	.80	.46	.04023 1287	8 51 34
	6 9 47 48.950 +10.746	+14 02 20.20 -53.33	1.80	0.46	19.02736 -1305	8 47 49
	7 9 47 59.696 10.606	14 01 26.87 52.61	.80	.46	.01431 1323	8 44 04
	8 9 48 10.302 10.464	14 00 34.26 51.88	.80	.46	19.00108 1342	8 40 19
	9 9 48 20.766 10.318	13 59 42.38 51.13	.81	.46	18.98766 1359	8 36 33
	10 9 48 31.084 10.170	13 58 51.25 50.36	.81	.46	.97407 1376	8 32 47
	11 9 48 41.254 +10.018	+13 58 00.89 -49.57	1.81	0.46	18.96031 -1393	8 29 01
	12 9 48 51.272 9.863	13 57 11.32 48.77	.81	.46	.94638 1410	8 25 16
	13 9 49 01.135 9.705	13 56 22.55 47.95	.81	.46	.93228 1426	8 21 29
	14 9 49 10.840 9.545	13 55 34.60 47.11	.81	.47	.91802 1442	8 17 43
	15 9 49 20.385 9.382	13 54 47.49 46.28	.81	.47	.90360 1458	8 13 57
	16 9 49 29.767 +9.216	+13 54 01.21 -45.41	1.81	0.47	18.88902 -1473	8 10 10
	17 9 49 38.983 9.048	13 53 15.80 44.56	.82	.47	.87429 1488	8 06 23
	18 9 49 48.031 8.879	13 52 31.24 43.68	.82	.47	.85941 1502	8 02 36
	19 9 49 56.910 8.708	13 51 47.56 42.80	.82	.47	.84439 1516	7 58 49
	20 9 50 05.618 8.536	13 51 04.76 41.93	.82	.47	.82923 1530	7 55 02
	21 9 50 14.154 +8.362	+13 50 22.83 -41.03	1.82	0.47	18.81393 -1543	7 51 14
	22 9 50 22.516 8.188	13 49 41.80 40.12	.82	.47	.79850 1556	7 47 27
	23 9 50 30.704 8.011	13 49 01.68 39.20	.83	.47	.78294 1568	7 43 39
	24 9 50 38.715 7.831	13 48 22.48 38.26	.83	.47	.76726 1580	7 39 51
	25 9 50 46.546 7.649	13 47 44.22 37.29	.83	.47	.75146 1591	7 36 03
	26 9 50 54.195 +7.463	+13 47 06.93 -36.31	1.83	0.47	18.73555 -1602	7 32 14
	27 9 51 01.658 7.274	13 46 30.62 35.33	.83	.47	.71953 1612	7 28 26
	28 9 51 08.932 7.084	13 45 55.29 34.33	.83	.47	.70341 1623	7 24 37
	29 9 51 16.016 6.892	13 45 20.96 33.33	.83	.47	.68718 1632	7 20 48
	30 9 51 22.908 6.699	13 44 47.63 32.33	.84	.47	.67086 1641	7 16 59
	31 9 51 29.607 +6.507	+13 44 15.30 -31.33	1.84	0.47	18.65445 -1649	7 13 10
Nov.	1 9 51 36.114 6.312	13 43 43.97 30.32	.84	.47	.63796 1658	7 09 20
	2 9 51 42.426 6.120	13 43 13.65 29.31	.84	.47	.62138 1666	7 05 31
	3 9 51 48.546 5.924	13 42 44.34 28.30	.84	.47	.60472 1673	7 01 41
	4 9 51 54.470 5.729	13 42 16.04 27.27	.84	.47	.58799 1681	6 57 51
	5 9 52 00.199 +5.532	+13 41 48.77 -26.23	1.85	0.47	18.57118 -1686	6 54 00
	6 9 52 05.731 5.332	13 41 22.54 25.17	.85	.47	.55432 1693	6 50 10
	7 9 52 11.063 5.131	13 40 57.37 24.11	.85	.47	.53739 1698	6 46 19
	8 9 52 16.194 4.927	13 40 33.26 23.02	.85	.48	.52041 1704	6 42 28
	9 9 52 21.121 4.722	13 40 10.24 21.94	.85	.48	.50337 1708	6 38 37
	10 9 52 25.843 +4.513	+13 39 48.30 -20.85	1.85	0.48	18.48629 -1712	6 34 46
	11 9 52 30.356 4.305	13 39 27.45 19.74	.86	.48	.46917 1716	6 30 54
	12 9 52 34.661 4.093	13 39 07.71 18.63	.86	.48	.45201 1719	6 27 03
	13 9 52 38.754 3.882	13 38 49.08 17.52	.86	.48	.43482 1722	6 23 11
	14 9 52 42.636 3.670	13 38 31.56 16.42	.86	.48	.41760 1725	6 19 19
	15 9 52 46.306 +3.456	+13 38 15.14 -15.31	1.86	0.48	18.40035 -1725	6 15 26
	16 9 52 49.762	+13 37 59.83	1.86	0.48	18.38310	6 11 34

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	9 52 49.762 + 3.244	+13 37 59.83 - 14.19	1.86	0.48	18.38310 -1728	6 11 34
17	9 52 53.006 + 3.031	13 37 45.64 13.09	.87	.48	.36582 1727	6 07 41
18	9 52 56.037 2.819	13 37 32.55 11.97	.87	.48	.34855 1728	6 03 48
19	9 52 58.856 2.604	13 37 20.58 10.85	.87	.48	.33127 1728	5 59 55
20	9 53 01.460 2.391	13 37 09.73 9.71	.87	.48	.31399 1726	5 56 02
21	9 53 03.851 + 2.174	+13 37 00.02 - 8.58	1.87	0.48	18.29673 -1725	5 52 08
22	9 53 06.025 1.956	13 36 51.44 7.41	.88	.48	.27948 1722	5 48 14
23	9 53 07.981 1.737	13 36 44.03 6.26	.88	.48	.26226 1720	5 44 20
24	9 53 09.718 1.515	13 36 37.77 5.11	.88	.48	.24506 1717	5 40 26
25	9 53 11.233 1.295	13 36 32.66 3.94	.88	.48	.22789 1712	5 36 32
26	9 53 12.528 + 1.075	+13 36 28.72 - 2.81	1.88	0.48	18.21077 -1709	5 32 37
27	9 53 13.603 0.856	13 36 25.91 1.66	.88	.48	.19368 1704	5 28 42
28	9 53 14.459 0.639	13 36 24.25 - 0.53	.89	.48	.17664 1698	5 24 47
29	9 53 15.098 0.422	13 36 23.72 + 0.58	.89	.48	.15966 1693	5 20 52
30	9 53 15.520 + 0.207	13 36 24.30 1.71	.89	.49	.14273 1686	5 16 56
Dec. 1	9 53 15.727 - 0.008	+13 36 26.01 + 2.84	1.89	0.49	18.12587 -1679	5 13 00
2	9 53 15.719 0.222	13 36 28.85 3.95	.89	.49	.10908 1672	5 09 04
3	9 53 15.497 0.437	13 36 32.80 5.09	.89	.49	.09236 1665	5 05 08
4	9 53 15.060 0.652	13 36 37.89 6.21	.90	.49	.07571 1656	5 01 12
5	9 53 14.408 0.869	13 36 44.10 7.35	.90	.49	.05915 1647	4 57 15
6	9 53 13.539 - 1.083	+13 36 51.45 + 8.47	1.90	0.49	18.04268 -1639	4 53 18
7	9 53 12.456 1.300	13 36 59.92 9.60	.90	.49	.02629 1628	4 49 21
8	9 53 11.156 1.516	13 37 09.52 10.73	.90	.49	18.01001 1618	4 45 24
9	9 53 09.640 1.732	13 37 20.25 11.85	.91	.49	17.99383 1607	4 41 27
10	9 53 07.908 1.946	13 37 32.10 12.96	.91	.49	.97776 1596	4 37 29
11	9 53 05.962 - 2.160	+13 37 45.06 + 14.05	1.91	0.49	17.96180 -1584	4 33 31
12	9 53 03.802 2.373	13 37 59.11 15.15	.91	.49	.94596 1572	4 29 33
13	9 53 01.429 2.583	13 38 14.26 16.22	.91	.49	.93024 1559	4 25 35
14	9 52 58.846 2.792	13 38 30.48 17.29	.91	.49	.91465 1545	4 21 36
15	9 52 56.054 2.998	13 38 47.77 18.35	.92	.49	.89920 1531	4 17 37
16	9 52 53.056 - 3.203	+13 39 06.12 + 19.39	1.92	0.49	17.88389 -1517	4 13 38
17	9 52 49.853 3.407	13 39 25.51 20.44	.92	.49	.86872 1502	4 09 39
18	9 52 46.446 3.609	13 39 45.95 21.49	.92	.49	.85370 1486	4 05 40
19	9 52 42.837 3.812	13 40 07.44 22.53	.92	.49	.83884 1471	4 01 41
20	9 52 39.025 4.014	13 40 29.97 23.58	.92	.49	.82413 1453	3 57 41
21	9 52 35.011 - 4.216	+13 40 53.55 + 24.61	1.92	0.49	17.80960 -1436	3 53 41
22	9 52 30.795 4.417	13 41 18.16 25.62	.93	.49	.79524 1419	3 49 41
23	9 52 26.378 4.613	13 41 43.78 26.62	.93	.49	.78105 1401	3 45 40
24	9 52 21.765 4.807	13 42 10.40 27.59	.93	.50	.76704 1382	3 41 40
25	9 52 16.958 4.998	13 42 37.99 28.54	.93	.50	.75322 1363	3 37 39
26	9 52 11.960 - 5.184	+13 43 06.53 + 29.48	1.93	0.50	17.73959 -1344	3 33 38
27	9 52 06.776 5.369	13 43 36.01 30.39	.93	.50	.72615 1323	3 29 37
28	9 52 01.407 5.548	13 44 06.40 31.30	.94	.50	.71292 1304	3 25 36
29	9 51 55.859 5.727	13 44 37.70 32.19	.94	.50	.69988 1283	3 21 34
30	9 51 50.132 5.903	13 45 09.89 33.08	.94	.50	.68705 1262	3 17 33
31	9 51 44.229 - 6.078	+13 45 42.97 + 33.96	1.94	0.50	17.67443 -1240	3 13 31
32	9 51 38.151	+13 46 16.93	1.94	0.50	17.66203	3 09 29

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Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Jan.	0	14 27 26.259	+5.199	-12 44 36.08	-22.29		1.19	0.29	30.81233	-1513		7 51 29
	1	14 27 31.458	5.086	12 44 58.37	21.68		.19	.29	.79720	1527		7 47 38
	2	14 27 36.544	4.972	12 45 20.05	21.09		.19	.29	.78193	1541		7 43 47
	3	14 27 41.516	4.856	12 45 41.14	20.46		.19	.29	.76652	1555		7 39 56
	4	14 27 46.372	4.741	12 46 01.60	19.86		.19	.29	.75097	1568		7 36 05
	5	14 27 51.113	+4.626	-12 46 21.46	-19.25		1.19	0.29	30.73529	-1581		7 32 14
	6	14 27 55.739	4.511	12 46 40.71	18.64		.19	.29	.71948	1592		7 28 22
	7	14 28 00.250	4.396	12 46 59.35	18.03		.19	.29	.70356	1604		7 24 31
	8	14 28 04.646	4.279	12 47 17.38	17.43		.19	.29	.68752	1615		7 20 39
	9	14 28 08.925	4.161	12 47 34.81	16.81		.19	.29	.67137	1626		7 16 48
	10	14 28 13.086	+4.043	-12 47 51.62	-16.22		1.19	0.29	30.65511	-1636		7 12 56
	11	14 28 17.129	3.922	12 48 07.84	15.59		.19	.29	.63875	1645		7 09 04
	12	14 28 21.051	3.801	12 48 23.43	14.98		.19	.29	.62230	1655		7 05 12
	13	14 28 24.852	3.678	12 48 38.41	14.36		.19	.29	.60575	1663		7 01 20
	14	14 28 28.530	3.553	12 48 52.77	13.73		.20	.29	.58912	1672		6 57 27
	15	14 28 32.083	+3.428	-12 49 06.50	-13.08		1.20	0.29	30.57240	-1680		6 53 35
	16	14 28 35.511	3.300	12 49 19.58	12.45		.20	.29	.55560	1687		6 49 42
	17	14 28 38.811	3.173	12 49 32.03	11.79		.20	.29	.53873	1693		6 45 50
	18	14 28 41.984	3.045	12 49 43.82	11.14		.20	.29	.52180	1700		6 41 57
	19	14 28 45.029	2.917	12 49 54.96	10.49		.20	.29	.50480	1706		6 38 04
	20	14 28 47.946	+2.790	-12 50 05.45	-9.84		1.20	0.29	30.48774	-1712		6 34 11
	21	14 28 50.736	2.663	12 50 15.29	9.19		.20	.29	.47062	1716		6 30 18
	22	14 28 53.399	2.535	12 50 24.48	8.54		.20	.29	.45346	1720		6 26 25
	23	14 28 55.934	2.408	12 50 33.02	7.92		.20	.29	.43626	1725		6 22 31
	24	14 28 58.342	2.280	12 50 40.94	7.27		.20	.29	.41901	1728		6 18 38
	25	14 29 00.622	+2.149	-12 50 48.21	-6.64		1.20	0.29	30.40173	-1730		6 14 44
	26	14 29 02.771	2.017	12 50 54.85	6.00		.20	.29	.38443	1733		6 10 50
	27	14 29 04.788	1.881	12 51 00.85	5.34		.20	.29	.36710	1735		6 06 56
	28	14 29 06.669	1.746	12 51 06.19	4.67		.20	.29	.34975	1735		6 03 02
	29	14 29 08.415	1.609	12 51 10.86	4.01		.21	.29	.33240	1736		5 59 08
Feb.	30	14 29 10.024	+1.474	-12 51 14.87	-3.33		1.21	0.29	30.31504	-1736		5 55 14
	31	14 29 11.498	1.338	12 51 18.20	2.65		.21	.29	.29768	1735		5 51 19
	1	14 29 12.836	1.204	12 51 20.85	1.99		.21	.29	.28033	1735		5 47 25
	2	14 29 14.040	1.071	12 51 22.84	1.33		.21	.29	.26298	1732		5 43 30
	3	14 29 15.111	0.939	12 51 24.17	0.68		.21	.29	.24566	1730		5 39 35
	4	14 29 16.050	+0.807	-12 51 24.85	-0.04		1.21	0.29	30.22836	-1727		5 35 40
	5	14 29 16.857	0.675	12 51 24.89	+0.61		.21	.29	.21109	1724		5 31 45
	6	14 29 17.532	0.544	12 51 24.28	1.24		.21	.29	.19385	1720		5 27 49
	7	14 29 18.076	0.411	12 51 23.04	1.87		.21	.29	.17665	1716		5 23 54
	8	14 29 18.487	0.279	12 51 21.17	2.51		.21	.29	.15949	1711		5 19 59
	9	14 29 18.766	+0.147	-12 51 18.66	+3.15		1.21	0.29	30.14238	-1705		5 16 03
	10	14 29 18.913	+0.012	12 51 15.51	3.78		.21	.29	.12533	1700		5 12 07
	11	14 29 18.925	-0.120	12 51 11.73	4.41		.21	.29	.10833	1693		5 08 11
	12	14 29 18.805	0.253	12 51 07.32	5.06		.21	.29	.09140	1686		5 04 15
	13	14 29 18.552	0.388	12 51 02.26	5.69		.22	.29	.07454	1679		5 00 19
	14	14 29 18.164	-0.519	-12 50 56.57	+6.34		1.22	0.29	30.05775	-1672		4 56 23
	15	14 29 17.645		-12 50 50.23			1.22	0.29	30.04103			4 52 26

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	14 29 17.645	-12 50 50.23	1.22	0.29	30.04103	4 52 26
16	14 29 16.995	12 50 43.27	.22	.29	.02441	4 48 30
17	14 29 16.215	12 50 35.67	.22	.29	30.00787	4 44 33
18	14 29 15.307	12 50 27.46	.22	.29	29.99142	4 40 36
19	14 29 14.272	12 50 18.64	.22	.29	.97507	4 36 39
20	14 29 13.111	-12 50 09.22	1.22	0.29	29.95882	4 32 42
21	14 29 11.824	12 49 59.21	.22	.29	.94268	4 28 45
22	14 29 10.411	12 49 48.61	.22	.29	.92666	4 24 47
23	14 29 08.871	12 49 37.44	.22	.29	.91075	4 20 50
24	14 29 07.203	12 49 25.68	.22	.29	.89497	4 16 52
25	14 29 05.408	-12 49 13.32	1.22	0.29	29.87931	4 12 55
26	14 29 03.484	12 49 00.37	.22	.29	.86380	4 08 57
27	14 29 01.435	12 48 46.82	.22	.29	.84841	4 04 59
28	14 28 59.260	12 48 32.69	.23	.29	.83318	4 01 01
29	14 28 56.964	12 48 17.97	.23	.30	.81809	3 57 03
Mar. 1	14 28 54.548	-12 48 02.69	1.23	0.30	29.80316	3 53 04
2	14 28 52.013	12 47 46.86	.23	.30	.78839	3 49 06
3	14 28 49.364	12 47 30.49	.23	.30	.77378	3 45 07
4	14 28 46.599	12 47 13.59	.23	.30	.75934	3 41 09
5	14 28 43.721	12 46 56.17	.23	.30	.74507	3 37 10
6	14 28 40.730	-12 46 38.23	1.23	0.30	29.73098	3 33 11
7	14 28 37.628	12 46 19.80	.23	.30	.71707	3 29 12
8	14 28 34.415	12 46 00.87	.23	.30	.70335	3 25 13
9	14 28 31.092	12 45 41.43	.23	.30	.68981	3 21 14
10	14 28 27.660	12 45 21.51	.23	.30	.67647	3 17 14
11	14 28 24.120	-12 45 01.09	1.23	0.30	29.66332	3 13 15
12	14 28 20.473	12 44 40.19	.23	.30	.65038	3 09 15
13	14 28 16.721	12 44 18.82	.23	.30	.63763	3 05 16
14	14 28 12.868	12 43 56.97	.23	.30	.62510	3 01 16
15	14 28 08.914	12 43 34.67	.23	.30	.61278	2 57 16
16	14 28 04.862	-12 43 11.92	1.24	0.30	29.60067	2 53 16
17	14 28 00.716	12 42 48.73	.24	.30	.58877	2 49 16
18	14 27 56.477	12 42 25.14	.24	.30	.57710	2 45 16
19	14 27 52.147	12 42 01.15	.24	.30	.56566	2 41 16
20	14 27 47.726	12 41 36.76	.24	.30	.55444	2 37 15
21	14 27 43.215	-12 41 11.99	1.24	0.30	29.54346	2 33 15
22	14 27 38.614	12 40 46.84	.24	.30	.53271	2 29 14
23	14 27 33.924	12 40 21.31	.24	.30	.52221	2 25 14
24	14 27 29.147	12 39 55.39	.24	.30	.51194	2 21 13
25	14 27 24.283	12 39 29.10	.24	.30	.50193	2 17 12
26	14 27 19.337	-12 39 02.44	1.24	0.30	29.49216	2 13 12
27	14 27 14.310	12 38 35.44	.24	.30	.48264	2 09 11
28	14 27 09.207	12 38 08.10	.24	.30	.47339	2 05 10
29	14 27 04.031	12 37 40.43	.24	.30	.46439	2 01 09
30	14 26 58.783	12 37 12.46	.24	.30	.45565	1 57 08
31	14 26 53.468	-12 36 44.21	1.24	0.30	29.44718	1 53 06
Apr. 1	14 26 48.087	12 36 15.68	1.24	0.30	29.43898	1 49 05

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	14 26 48.087 -5.445	-12 36 15.68 +28.78	1.24	0.30	29.43898 - 794	1 49 05
2	14 26 42.642 5.508	12 35 46.90 29.04	.24	.30	.43104 766	1 45 04
3	14 26 37.134 5.568	12 35 17.86 29.27	.24	.30	.42338 739	1 41 02
4	14 26 31.566 5.628	12 34 48.59 29.51	.24	.30	.41599 712	1 37 01
5	14 26 25.938 5.684	12 34 19.08 29.73	.24	.30	.40887 683	1 32 59
6	14 26 20.254 -5.740	-12 33 49.35 +29.94	1.24	0.30	29.40204 - 656	1 28 58
7	14 26 14.514 5.793	12 33 19.41 30.16	.24	.30	.39548 628	1 24 56
8	14 26 08.721 5.844	12 32 49.25 30.35	.24	.30	.38920 600	1 20 54
9	14 26 02.877 5.892	12 32 18.90 30.55	.24	.30	.38320 571	1 16 53
10	14 25 56.985 5.937	12 31 48.35 30.72	.24	.30	.37749 543	1 12 51
11	14 25 51.048 -5.979	-12 31 17.63 +30.88	1.24	0.30	29.37206 - 515	1 08 49
12	14 25 45.069 6.017	12 30 46.75 31.03	.24	.30	.36691 486	1 04 47
13	14 25 39.052 6.052	12 30 15.72 31.15	.25	.30	.36205 457	1 00 45
14	14 25 33.000 6.085	12 29 44.57 31.25	.25	.30	.35748 428	0 56 44
15	14 25 26.915 6.117	12 29 13.32 31.35	.25	.30	.35320 399	0 52 42
16	14 25 20.798 -6.147	-12 28 41.97 +31.42	1.25	0.30	29.34921 - 370	0 48 40
17	14 25 14.651 6.178	12 28 10.55 31.51	.25	.30	.34551 340	0 44 38
18	14 25 08.473 6.206	12 27 39.04 31.58	.25	.30	.34211 311	0 40 36
19	14 25 02.267 6.233	12 27 07.46 31.66	.25	.30	.33900 282	0 36 33
20	14 24 56.034 6.258	12 26 35.80 31.71	.25	.30	.33618 252	0 32 31
21	14 24 49.776 -6.279	-12 26 04.09 +31.77	1.25	0.30	29.33366 - 222	0 28 29
22	14 24 43.497 6.297	12 25 32.32 31.81	.25	.30	.33144 193	0 24 27
23	14 24 37.200 6.312	12 25 00.51 31.84	.25	.30	.32951 162	0 20 25
24	14 24 30.888 6.323	12 24 28.67 31.84	.25	.30	.32789 133	0 16 23
25	14 24 24.565 6.330	12 23 56.83 31.83	.25	.30	.32656 103	0 12 21
26	14 24 18.235 -6.335	-12 23 25.00 +31.80	1.25	0.30	29.32553 - 72	0 08 18
27	14 24 11.900 6.338	12 22 53.20 31.74	.25	.30	.32481 43	0 04 16
28	14 24 05.562 6.337	12 22 21.46 31.69	.25	.30	.32438 - 13	{ 0 00 14 } { 23 56 12 }
29	14 23 59.225 6.335	12 21 49.77 31.61	.25	.30	.32425 + 17	23 52 09
30	14 23 52.890 6.331	12 21 18.16 31.53	.25	.30	.32442 47	23 48 07
May 1	14 23 46.559 -6.325	-12 20 46.63 +31.43	1.25	0.30	29.32489 + 77	23 44 05
2	14 23 40.234 6.317	12 20 15.20 31.33	.25	.30	.32566 106	23 40 03
3	14 23 33.917 6.307	12 19 43.87 31.23	.25	.30	.32672 136	23 36 01
4	14 23 27.610 6.296	12 19 12.64 31.10	.25	.30	.32808 166	23 31 58
5	14 23 21.314 6.281	12 18 41.54 30.98	.25	.30	.32974 195	23 27 56
6	14 23 15.033 -6.265	-12 18 10.56 +30.84	1.25	0.30	29.33169 + 224	23 23 54
7	14 23 08.768 6.244	12 17 39.72 30.69	.25	.30	.33393 254	23 19 52
8	14 23 02.524 6.221	12 17 09.03 30.53	.25	.30	.33647 283	23 15 50
9	14 22 56.303 6.194	12 16 38.50 30.35	.25	.30	.33930 311	23 11 48
10	14 22 50.109 6.164	12 16 08.15 30.15	.25	.30	.34241 340	23 07 46
11	14 22 43.945 -6.132	-12 15 38.00 +29.93	1.25	0.30	29.34581 + 369	23 03 44
12	14 22 37.813 6.097	12 15 08.07 29.68	.25	.30	.34950 398	22 59 42
13	14 22 31.716 6.063	12 14 38.39 29.46	.25	.30	.35348 426	22 55 40
14	14 22 25.653 6.027	12 14 08.93 29.20	.25	.30	.35774 454	22 51 38
15	14 22 19.626 5.991	12 13 39.73 28.96	.25	.30	.36228 482	22 47 36
16	14 22 13.635 -5.954	-12 13 10.77 +28.70	1.24	0.30	29.36710 + 511	22 43 34
17	14 22 07.681	-12 12 42.07	1.24	0.30	29.37221	22 39 33

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Date		Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
		^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May	17	14 22 07.681	-12 12 42.07	1.24	0.30	29.37221	22 39 33
	18	14 22 01.767	12 12 13.62	.24	.30	.37759 + 538	22 35 31
	19	14 21 55.895	12 11 45.43	.24	.30	.38326 567	22 31 29
	20	14 21 50.069	12 11 17.51	.24	.30	.38919 593	22 27 28
	21	14 21 44.291	12 10 49.89	.24	.30	.39541 622	22 23 26
	22	14 21 38.565	-12 10 22.57	1.24	0.30	29.40189	22 19 24
	23	14 21 32.894	12 09 55.57	.24	.30	.40865 + 676	22 15 23
	24	14 21 27.281	12 09 28.92	.24	.30	.41567 702	22 11 21
	25	14 21 21.728	12 09 02.61	.24	.30	.42296 729	22 07 20
	26	14 21 16.236	12 08 36.68	.24	.30	.43052 756	22 03 19
	27	14 21 10.809	-12 08 11.12	1.24	0.30	29.43833	21 59 17
	28	14 21 05.447	12 07 45.94	.24	.30	.44641 + 808	21 55 16
	29	14 21 00.150	12 07 21.16	.24	.30	.45473 832	21 51 15
	30	14 20 54.923	12 06 56.77	.24	.30	.46331 858	21 47 14
	31	14 20 49.764	12 06 32.79	.24	.30	.47214 883	21 43 13
June	1	14 20 44.676	-12 06 09.22	1.24	0.30	29.48122	21 39 12
	2	14 20 39.661	12 05 46.06	.24	.30	.49054 + 932	21 35 11
	3	14 20 34.720	12 05 23.32	.24	.30	.50010 956	21 31 11
	4	14 20 29.857	12 05 01.01	.24	.30	.50989 979	21 27 10
	5	14 20 25.073	12 04 39.14	.24	.30	.51992 1003	21 23 09
	6	14 20 20.370	-12 04 17.73	1.24	0.30	29.53018	21 19 09
	7	14 20 15.754	12 03 56.77	.24	.30	.54066 + 1048	21 15 08
	8	14 20 11.224	12 03 36.30	.24	.30	.55137 1071	21 11 08
	9	14 20 06.783	12 03 16.33	.24	.30	.56230 1093	21 07 08
	10	14 20 02.432	12 02 56.86	.24	.30	.57344 1114	21 03 08
	11	14 19 58.170	-12 02 37.91	1.24	0.30	29.58480	20 59 08
	12	14 19 53.996	12 02 19.45	.24	.30	.59636 + 1156	20 55 08
	13	14 19 49.911	12 02 01.49	.23	.30	.60814 1178	20 51 08
	14	14 19 45.917	12 01 44.04	.23	.30	.62012 1198	20 47 08
	15	14 19 42.013	12 01 27.09	.23	.30	.63229 1217	20 43 08
	16	14 19 38.203	-12 01 10.64	1.23	0.30	29.64467	20 39 09
	17	14 19 34.490	12 00 54.71	.23	.30	.65724 + 1257	20 35 09
	18	14 19 30.877	12 00 39.32	.23	.30	.67000 1276	20 31 10
	19	14 19 27.365	12 00 24.47	.23	.30	.68295 1295	20 27 10
	20	14 19 23.955	12 00 10.17	.23	.30	.69608 1313	20 23 11
	21	14 19 20.651	-11 59 56.44	1.23	0.30	29.70939	20 19 12
	22	14 19 17.454	11 59 43.29	.23	.30	.72288 + 1349	20 15 13
	23	14 19 14.363	11 59 30.72	.23	.30	.73653 1365	20 11 14
	24	14 19 11.381	11 59 18.73	.23	.30	.75035 1382	20 07 15
	25	14 19 08.506	11 59 07.33	.23	.30	.76434 1399	20 03 17
	26	14 19 05.740	-11 58 56.52	1.23	0.30	29.77848	19 59 18
	27	14 19 03.084	11 58 46.30	.23	.30	.79277 + 1429	19 55 20
	28	14 19 00.537	11 58 36.67	.23	.30	.80722 1445	19 51 21
	29	14 18 58.101	11 58 27.64	.23	.30	.82180 1458	19 47 23
	30	14 18 55.778	11 58 19.19	.23	.29	.83653 1473	19 43 25
July	1	14 18 53.567	-11 58 11.34	1.22	0.29	29.85139	19 39 27
	2	14 18 51.471	-11 58 04.09	1.22	0.29	29.86639 + 1500	19 35 29

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	14 18 53.567 -2.096	-11 58 11.34 + 7.25	1.22	0.29	29.85139 +1500	19 39 27
2	14 18 51.471 1.980	11 58 04.09 + 6.64	.22	.29	.86639 1512	19 35 29
3	14 18 49.491 1.862	11 57 57.45 + 6.03	.22	.29	.88151 1523	19 31 31
4	14 18 47.629 1.743	11 57 51.42 + 5.40	.22	.29	.89674 1536	19 27 34
5	14 18 45.886 1.622	11 57 46.02 + 4.76	.22	.29	.91210 1547	19 23 36
6	14 18 44.264 -1.501	-11 57 41.26 + 4.13	1.22	0.29	29.92757 +1557	19 19 39
7	14 18 42.763 1.381	11 57 37.13 + 3.49	.22	.29	.94314 1568	19 15 41
8	14 18 41.382 1.262	11 57 33.64 + 2.84	.22	.29	.95882 1578	19 11 44
9	14 18 40.120 1.146	11 57 30.80 + 2.22	.22	.29	.97460 1588	19 07 47
10	14 18 38.974 1.028	11 57 28.58 + 1.60	.22	.29	29.99048 1596	19 03 50
11	14 18 37.946 -0.911	-11 57 26.98 + 0.99	1.22	0.29	30.00644 +1606	18 59 53
12	14 18 37.035 0.793	11 57 25.99 + 0.38	.22	.29	.02250 1613	18 55 56
13	14 18 36.242 0.672	11 57 25.61 - 0.24	.22	.29	.03863 1622	18 52 00
14	14 18 35.570 0.551	11 57 25.85 - 0.86	.22	.29	.05485 1629	18 48 03
15	14 18 35.019 0.426	11 57 26.71 - 1.49	.22	.29	.07114 1635	18 44 07
16	14 18 34.593 -0.303	-11 57 28.20 - 2.13	1.22	0.29	30.08749 +1643	18 40 11
17	14 18 34.290 0.177	11 57 30.33 + 2.78	.21	.29	.10392 1648	18 36 15
18	14 18 34.113 -0.052	11 57 33.11 + 3.42	.21	.29	.12040 1654	18 32 19
19	14 18 34.061 +0.074	11 57 36.53 + 4.07	.21	.29	.13694 1659	18 28 23
20	14 18 34.135 0.200	11 57 40.60 + 4.72	.21	.29	.15353 1664	18 24 27
21	14 18 34.335 +0.324	-11 57 45.32 - 5.37	1.21	0.29	30.17017 +1668	18 20 31
22	14 18 34.659 0.449	11 57 50.69 + 6.01	.21	.29	.18685 1671	18 16 36
23	14 18 35.108 0.572	11 57 56.70 + 6.66	.21	.29	.20356 1675	18 12 41
24	14 18 35.680 0.697	11 58 03.36 + 7.28	.21	.29	.22031 1677	18 08 45
25	14 18 36.377 0.820	11 58 10.64 + 7.92	.21	.29	.23708 1679	18 04 50
26	14 18 37.197 +0.943	-11 58 18.56 - 8.54	1.21	0.29	30.25387 +1681	18 00 55
27	14 18 38.140 1.067	11 58 27.10 + 9.16	.21	.29	.27068 1682	17 57 00
28	14 18 39.207 1.192	11 58 36.26 + 9.79	.21	.29	.28750 1683	17 53 06
29	14 18 40.399 1.316	11 58 46.05 + 10.40	.21	.29	.30433 1683	17 49 11
30	14 18 41.715 1.442	11 58 56.45 + 11.04	.21	.29	.32116 1682	17 45 16
31	14 18 43.157 +1.569	-11 59 07.49 - 11.66	1.21	0.29	30.33798 +1682	17 41 22
Aug. 1	14 18 44.726 1.694	11 59 19.15 + 12.30	.20	.29	.35480 1680	17 37 28
2	14 18 46.420 1.821	11 59 31.45 + 12.93	.20	.29	.37160 1679	17 33 34
3	14 18 48.241 1.946	11 59 44.38 + 13.57	.20	.29	.38839 1676	17 29 40
4	14 18 50.187 2.069	11 59 57.95 + 14.19	.20	.29	.40515 1673	17 25 46
5	14 18 52.256 +2.190	-12 00 12.14 - 14.81	1.20	0.29	30.42188 +1671	17 21 52
6	14 18 54.446 2.308	12 00 26.95 + 15.42	.20	.29	.43859 1667	17 17 58
7	14 18 56.754 2.427	12 00 42.37 + 16.00	.20	.29	.45526 1663	17 14 05
8	14 18 59.181 2.544	12 00 58.37 + 16.57	.20	.29	.47189 1659	17 10 11
9	14 19 01.725 2.663	12 01 14.94 + 17.16	.20	.29	.48848 1654	17 06 18
10	14 19 04.388 +2.783	-12 01 32.10 - 17.73	1.20	0.29	30.50502 +1649	17 02 25
11	14 19 07.171 2.903	12 01 49.83 + 18.31	.20	.29	.52151 1643	16 58 32
12	14 19 10.074 3.023	12 02 08.14 + 18.90	.20	.29	.53794 1637	16 54 39
13	14 19 13.097 3.145	12 02 27.04 + 19.49	.20	.29	.55431 1631	16 50 46
14	14 19 16.242 3.264	12 02 46.53 + 20.08	.20	.29	.57062 1623	16 46 53
15	14 19 19.506 +3.384	-12 03 06.61 - 20.66	1.20	0.29	30.58685 +1616	16 43 01
16	14 19 22.890	-12 03 27.27	1.19	0.29	30.60301	16 39 08

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	14 19 22.890	-12 03 27.27	1.19	0.29	30.60301	16 39 08
17	14 19 26.393 +3.503	12 03 48.50 -21.23	.19	.29	.61910 +1609	16 35 16
18	14 19 30.012 3.619	12 04 10.32 21.82	.19	.29	.63510 1600	16 31 24
19	14 19 33.748 3.736	12 04 32.69 22.37	.19	.29	.65101 1591	16 27 32
20	14 19 37.598 3.850	12 04 55.63 22.94	.19	.29	.66682 1581	16 23 40
	3.964	23.49			1572	
21	14 19 41.562	-12 05 19.12	1.19	0.29	30.68254	16 19 48
22	14 19 45.638 +4.076	12 05 43.14 -24.02	.19	.29	.69816 +1562	16 15 56
23	14 19 49.825 4.187	12 06 07.70 24.56	.19	.29	.71367 1551	16 12 04
24	14 19 54.122 4.297	12 06 32.77 25.07	.19	.29	.72907 1540	16 08 13
25	14 19 58.531 4.409	12 06 58.37 25.60	.19	.29	.74435 1528	16 04 21
	4.519	26.11			1517	
26	14 20 03.050	-12 07 24.48	1.19	0.29	30.75952	16 00 30
27	14 20 07.679 +4.629	12 07 51.10 -26.62	.19	.29	.77455 +1503	15 56 39
28	14 20 12.418 4.739	12 08 18.24 27.14	.19	.29	.78946 1491	15 52 48
29	14 20 17.267 4.849	12 08 45.89 27.65	.19	.29	.80424 1478	15 48 57
30	14 20 22.225 4.958	12 09 14.05 28.16	.19	.29	.81887 1463	15 45 06
	5.063	28.65			1450	
31	14 20 27.288	-12 09 42.70	1.19	0.29	30.83337	15 41 15
Sept. 1	14 20 32.457 +5.169	12 10 11.86 -29.16	.19	.29	.84772 +1435	15 37 24
2	14 20 37.727 5.270	12 10 41.51 29.65	.18	.29	.86192 1420	15 33 34
3	14 20 43.097 5.370	12 11 11.62 30.11	.18	.29	.87597 1405	15 29 43
4	14 20 48.564 5.467	12 11 42.18 30.56	.18	.28	.88986 1389	15 25 53
	5.563	30.99			1374	
5	14 20 54.127	-12 12 13.17	1.18	0.28	30.90360	15 22 02
6	14 20 59.785 +5.658	12 12 44.60 -31.43	.18	.28	.91717 +1357	15 18 12
7	14 21 05.539 5.754	12 13 16.44 31.84	.18	.28	.93058 1341	15 14 22
8	14 21 11.388 5.849	12 13 48.71 32.27	.18	.28	.94381 1323	15 10 32
9	14 21 17.334 5.946	12 14 21.40 32.69	.18	.28	.95688 1307	15 06 42
	6.040	33.12			1288	
10	14 21 23.374	-12 14 54.52	1.18	0.28	30.96976	15 02 52
11	14 21 29.510 +6.136	12 15 28.05 -33.53	.18	.28	.98247 +1271	14 59 03
12	14 21 35.737 6.227	12 16 02.00 33.95	.18	.28	30.99499 1252	14 55 13
13	14 21 42.056 6.319	12 16 36.35 34.35	.18	.28	31.00733 1234	14 51 23
14	14 21 48.464 6.408	12 17 11.11 34.76	.18	.28	.01947 1214	14 47 34
	6.496	35.14			1195	
15	14 21 54.960	-12 17 46.25	1.18	0.28	31.03142	14 43 44
16	14 22 01.540 +6.580	12 18 21.77 -35.52	.18	.28	.04317 +1175	14 39 55
17	14 22 08.205 6.665	12 18 57.66 35.89	.18	.28	.05472 1155	14 36 06
18	14 22 14.951 6.746	12 19 33.89 36.23	.18	.28	.06606 1134	14 32 17
19	14 22 21.778 6.827	12 20 10.47 36.58	.18	.28	.07719 1113	14 28 28
	6.905	36.91			1092	
20	14 22 28.683	-12 20 47.38	1.18	0.28	31.08811	14 24 39
21	14 22 35.666 +6.983	12 21 24.60 -37.22	.18	.28	.09881 +1070	14 20 50
22	14 22 42.727 7.061	12 22 02.14 37.54	.18	.28	.10930 1049	14 17 01
23	14 22 49.863 7.136	12 22 39.99 37.85	.17	.28	.11956 1026	14 13 12
24	14 22 57.076 7.213	12 23 18.15 38.16	.17	.28	.12960 1004	14 09 24
	7.287	38.46			980	
25	14 23 04.363	-12 23 56.61	1.17	0.28	31.13940	14 05 35
26	14 23 11.724 +7.361	12 24 35.37 -38.76	.17	.28	.14898 + 958	14 01 46
27	14 23 19.155 7.431	12 25 14.42 39.05	.17	.28	.15832 934	13 57 58
28	14 23 26.655 7.500	12 25 53.76 39.34	.17	.28	.16742 910	13 54 10
29	14 23 34.220 7.565	12 26 33.36 39.60	.17	.28	.17629 887	13 50 21
	7.628	39.85			862	
30	14 23 41.848	-12 27 13.21	1.17	0.28	31.18491	13 46 33
Oct. 1	14 23 49.534 +7.686	12 27 53.31 -40.10	1.17	0.28	31.19330 + 839	13 42 45

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct.	1 14 23 49.534 +7.744	-12 27 53.31 -40.30	1.17	0.28	31.19330 + 813	13 42 45
	2 14 23 57.278 7.801	12 28 33.61 40.50	.17	.28	.20143 789	13 38 56
	3 14 24 05.079 7.856	12 29 14.11 40.70	.17	.28	.20932 764	13 35 08
	4 14 24 12.935 7.911	12 29 54.81 40.89	.17	.28	.21696 739	13 31 20
	5 14 24 20.846 7.965	12 30 35.70 41.08	.17	.28	.22435 713	13 27 32
	6 14 24 28.811 +8.020	-12 31 16.78 -41.27	1.17	0.28	31.23148 + 688	13 23 44
	7 14 24 36.831 8.073	12 31 58.05 41.44	.17	.28	.23836 662	13 19 56
	8 14 24 44.904 8.123	12 32 39.49 41.63	.17	.28	.24498 637	13 16 09
	9 14 24 53.027 8.172	12 33 21.12 41.79	.17	.28	.25135 610	13 12 21
	10 14 25 01.199 8.219	12 34 02.91 41.96	.17	.28	.25745 584	13 08 33
	11 14 25 09.418 +8.263	-12 34 44.87 -42.10	1.17	0.28	31.26329 + 557	13 04 45
	12 14 25 17.681 8.305	12 35 26.97 42.23	.17	.28	.26886 530	13 00 58
	13 14 25 25.986 8.344	12 36 09.20 42.36	.17	.28	.27416 504	12 57 10
	14 14 25 34.330 8.382	12 36 51.56 42.46	.17	.28	.27920 476	12 53 22
	15 14 25 42.712 8.416	12 37 34.02 42.56	.17	.28	.28396 449	12 49 35
	16 14 25 51.128 +8.450	-12 38 16.58 -42.64	1.17	0.28	31.28845 + 422	12 45 47
	17 14 25 59.578 8.481	12 38 59.22 42.71	.17	.28	.29267 394	12 42 00
	18 14 26 08.059 8.512	12 39 41.93 42.77	.17	.28	.29661 366	12 38 12
	19 14 26 16.571 8.542	12 40 24.70 42.82	.17	.28	.30027 338	12 34 25
	20 14 26 25.113 8.570	12 41 07.52 42.87	.17	.28	.30365 310	12 30 38
	21 14 26 33.683 +8.597	-12 41 50.39 -42.93	1.17	0.28	31.30675 + 281	12 26 50
	22 14 26 42.280 8.624	12 42 33.32 42.96	.17	.28	.30956 254	12 23 03
	23 14 26 50.904 8.646	12 43 16.28 43.00	.17	.28	.31210 225	12 19 16
	24 14 26 59.550 8.667	12 43 59.28 43.02	.17	.28	.31435 196	12 15 28
	25 14 27 08.217 8.684	12 44 42.30 43.05	.17	.28	.31631 168	12 11 41
	26 14 27 16.901 +8.696	-12 45 25.35 -43.03	1.17	0.28	31.31799 + 140	12 07 54
	27 14 27 25.597 8.707	12 45 08.38 43.00	.17	.28	.31939 111	12 04 06
	28 14 27 34.304 8.714	12 46 51.38 42.96	.17	.28	.32050 82	12 00 19
	29 14 27 43.018 8.721	12 47 34.34 42.91	.17	.28	.32132 54	11 56 32
	30 14 27 51.739 8.725	12 48 17.25 42.83	.17	.28	.32186 + 25	11 52 45
Nov.	31 14 28 00.464 +8.730	-12 49 00.08 -42.76	1.17	0.28	31.32211 - 4	11 48 58
	1 14 28 09.194 8.733	12 49 42.84 42.69	.17	.28	.32207 32	11 45 10
	2 14 28 17.927 8.736	12 50 25.53 42.60	.17	.28	.32175 61	11 41 23
	3 14 28 26.663 8.737	12 51 08.13 42.52	.17	.28	.32114 89	11 37 36
	4 14 28 35.400 8.736	12 51 50.65 42.44	.17	.28	.32025 118	11 33 49
	5 14 28 44.136 +8.734	-12 52 33.09 -42.33	1.17	0.28	31.31907 - 146	11 30 01
	6 14 28 52.870 8.728	12 53 15.42 42.23	.17	.28	.31761 175	11 26 14
	7 14 29 01.598 8.720	12 53 57.65 42.12	.17	.28	.31586 204	11 22 27
	8 14 29 10.318 8.710	12 54 39.77 41.99	.17	.28	.31382 232	11 18 40
	9 14 29 19.028 8.697	12 55 21.76 41.84	.17	.28	.31150 261	11 14 52
	10 14 29 27.725 +8.681	-12 56 03.60 -41.69	1.17	0.28	31.30889 - 289	11 11 05
	11 14 29 36.406 8.663	12 56 45.29 41.53	.17	.28	.30600 318	11 07 18
	12 14 29 45.069 8.643	12 57 26.82 41.33	.17	.28	.30282 346	11 03 31
	13 14 29 53.712 8.621	12 58 08.15 41.15	.17	.28	.29936 375	10 59 43
	14 14 30 02.333 8.599	12 58 49.30 40.93	.17	.28	.29561 403	10 55 56
	15 14 30 10.932 +8.573	-12 59 30.23 -40.73	1.17	0.28	31.29158 - 432	10 52 09
	16 14 30 19.505	-13 00 10.96	1.17	0.28	31.28726	10 48 21

NEPTUNE, 1960

FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	14 30 19.505 ^s	-13 00 10.96 ["]	1.17	0.28	31.28726	10 48 21
17	14 30 28.054 ^s	13 00 51.48 ["]	.17	.28	.28267	10 44 34
18	14 30 36.576 ^s	13 01 31.78 ["]	.17	.28	.27779	10 40 46
19	14 30 45.070 ^s	13 02 11.85 ["]	.17	.28	.27263	10 36 59
20	14 30 53.533 ^s	13 02 51.70 ["]	.17	.28	.26719	10 33 11
21	14 31 01.964 ^s	-13 03 31.31 ["]	1.17	0.28	31.26147	10 29 24
22	14 31 10.358 ^s	13 04 10.68 ["]	.17	.28	.25548	10 25 36
23	14 31 18.711 ^s	13 04 49.79 ["]	.17	.28	.24922	10 21 49
24	14 31 27.020 ^s	13 05 28.62 ["]	.17	.28	.24268	10 18 01
25	14 31 35.283 ^s	13 06 07.14 ["]	.17	.28	.23587	10 14 13
26	14 31 43.497 ^s	-13 06 45.35 ["]	1.17	0.28	31.22880	10 10 25
27	14 31 51.661 ^s	13 07 23.24 ["]	.17	.28	.22146	10 06 38
28	14 31 59.775 ^s	13 08 00.79 ["]	.17	.28	.21385	10 02 50
29	14 32 07.838 ^s	13 08 38.01 ["]	.17	.28	.20599	9 59 02
30	14 32 15.849 ^s	13 09 14.90 ["]	.17	.28	.19786	9 55 14
Dec. 1	14 32 23.808 ^s	-13 09 51.45 ["]	1.17	0.28	31.18948	9 51 26
2	14 32 31.711 ^s	13 10 27.66 ["]	.17	.28	.18084	9 47 38
3	14 32 39.559 ^s	13 11 03.52 ["]	.17	.28	.17196	9 43 50
4	14 32 47.347 ^s	13 11 39.03 ["]	.17	.28	.16282	9 40 02
5	14 32 55.073 ^s	13 12 14.19 ["]	.17	.28	.15343	9 36 13
6	14 33 02.736 ^s	-13 12 48.96 ["]	1.17	0.28	31.14380	9 32 25
7	14 33 10.333 ^s	13 13 23.36 ["]	.17	.28	.13393	9 28 37
8	14 33 17.860 ^s	13 13 57.36 ["]	.17	.28	.12381	9 24 48
9	14 33 25.317 ^s	13 14 30.95 ["]	.18	.28	.11346	9 21 00
10	14 33 32.701 ^s	13 15 04.12 ["]	.18	.28	.10287	9 17 11
11	14 33 40.010 ^s	-13 15 36.87 ["]	1.18	0.28	31.09205	9 13 22
12	14 33 47.243 ^s	13 16 09.18 ["]	.18	.28	.08099	9 09 34
13	14 33 54.400 ^s	13 16 41.04 ["]	.18	.28	.06971	9 05 45
14	14 34 01.478 ^s	13 17 12.46 ["]	.18	.28	.05821	9 01 56
15	14 34 08.477 ^s	13 17 43.43 ["]	.18	.28	.04648	8 58 07
16	14 34 15.398 ^s	-13 18 13.95 ["]	1.18	0.28	31.03453	8 54 18
17	14 34 22.237 ^s	13 18 44.01 ["]	.18	.28	.02237	8 50 29
18	14 34 28.992 ^s	13 19 13.63 ["]	.18	.28	31.01000	8 46 40
19	14 34 35.661 ^s	13 19 42.78 ["]	.18	.28	30.99742	8 42 50
20	14 34 42.240 ^s	13 20 11.46 ["]	.18	.28	.98464	8 39 01
21	14 34 48.725 ^s	-13 20 39.65 ["]	1.18	0.28	30.97165	8 35 11
22	14 34 55.115 ^s	13 21 07.33 ["]	.18	.28	.95847	8 31 22
23	14 35 01.405 ^s	13 21 34.48 ["]	.18	.28	.94510	8 27 32
24	14 35 07.598 ^s	13 22 01.11 ["]	.18	.28	.93154	8 23 42
25	14 35 13.690 ^s	13 22 27.19 ["]	.18	.28	.91780	8 19 52
26	14 35 19.684 ^s	-13 22 52.74 ["]	1.18	0.28	30.90388	8 16 02
27	14 35 25.578 ^s	13 23 17.76 ["]	.18	.28	.88978	8 12 12
28	14 35 31.372 ^s	13 23 42.23 ["]	.18	.29	.87551	8 08 22
29	14 35 37.064 ^s	13 24 06.18 ["]	.18	.29	.86108	8 04 32
30	14 35 42.654 ^s	13 24 29.59 ["]	.19	.29	.84648	8 00 41
31	14 35 48.139 ^s	-13 24 52.47 ["]	1.19	0.29	30.83173	7 56 51
32	14 35 53.518 ^s	-13 25 14.79 ["]	1.19	0.29	30.81682	7 53 00

PLUTO, 1960

FOR 0^h EPHEMERIS TIME

Date	Astrometric Right Ascension 1950.0	Astrometric Declination 1950.0	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]		^h ^m
Jan. -1	10 50 16.914 - 8.220	+20 53 03.83 +150.30	0.26	33.31973 -5924	4 19
3	10 50 08.694 9.988	20 55 34.13 156.83	.26	.26049 5640	4 03
7	10 49 58.706 11.677	20 58 10.96 162.48	.27	.20409 5331	3 48
11	10 49 47.029 13.285	21 00 53.44 167.19	.27	.15078 4995	3 32
15	10 49 33.744 14.808	21 03 40.63 171.00	.27	.10083 4637	3 16
19	10 49 18.936 -16.240	+21 06 31.63 +173.87	0.27	33.05446 -4258	3 00
23	10 49 02.696 17.573	21 09 25.50 175.71	.27	33.01188 3854	2 44
27	10 48 45.123 18.786	21 12 21.21 176.49	.27	32.97334 3432	2 28
31	10 48 26.337 19.866	21 15 17.70 176.17	.27	.93902 2991	2 12
Feb. 4	10 48 06.471 20.808	21 18 13.87 174.80	.27	.90911 2540	1 56
8	10 47 45.663 -21.610	+21 21 08.67 +172.42	0.27	32.88371 -2077	1 40
12	10 47 24.053 22.275	21 24 01.09 169.08	.27	.86294 1609	1 23
16	10 47 01.778 22.805	21 26 50.17 164.81	.27	.84685 1133	1 07
20	10 46 38.973 23.189	21 29 34.98 159.56	.27	.83552 654	0 51
24	10 46 15.784 23.419	21 32 14.54 153.35	.27	.82898 -170	0 35
28	10 45 52.365 -23.488	+21 34 47.89 +146.22	0.27	32.82728 +311	0 19
Mar. 3	10 45 28.877 23.398	21 37 14.11 138.26	.27	.83039 787	0 03
7	10 45 05.479 23.157	21 39 32.37 129.57	.27	.83826 1253	23 43
11	10 44 42.322 22.774	21 41 41.94 120.23	.27	.85079 1710	23 27
15	10 44 19.548 22.255	21 43 42.17 110.27	.27	.86789 2155	23 11
19	10 43 57.293 -21.600	+21 45 32.44 +99.75	0.27	32.88944 +2588	22 55
23	10 43 35.693 20.806	21 47 12.19 88.64	.27	.91532 3006	22 38
27	10 43 14.887 19.871	21 48 40.83 77.08	.27	.94538 3407	22 22
31	10 42 55.016 18.809	21 49 57.91 65.13	.27	32.97945 3787	22 06
Apr. 4	10 42 36.207 17.631	21 51 03.04 52.95	.27	33.01732 4142	21 50
8	10 42 18.576 -16.353	+21 51 55.99 +40.59	0.27	33.05874 +4474	21 34
12	10 42 02.223 14.987	21 52 36.58 28.12	.27	.10348 4782	21 18
16	10 41 47.236 13.532	21 53 04.70 15.52	.27	.15130 5065	21 02
20	10 41 33.704 11.990	21 53 20.22 +2.85	.27	.20195 5325	20 46
24	10 41 21.714 10.366	21 53 23.07 -9.79	.26	.25520 5556	20 31
28	10 41 11.348 -8.675	+21 53 13.28 -22.34	0.26	33.31076 +5756	20 15
May 2	10 41 02.673 6.934	21 52 50.94 34.67	.26	.36832 5926	19 59
6	10 40 55.739 5.156	21 52 16.27 46.74	.26	.42758 6065	19 43
10	10 40 50.583 3.353	21 51 29.53 58.52	.26	.48823 6175	19 27
14	10 40 47.230 -1.527	21 50 31.01 70.02	.26	.54998 6258	19 11
18	10 40 45.703 +0.324	+21 49 20.99 -81.23	0.26	33.61256 +6312	18 56
22	10 40 46.027 2.191	21 47 59.76 92.05	.26	.67568 6335	18 40
26	10 40 48.218 4.059	21 46 27.71 102.41	.26	.73903 6326	18 24
30	10 40 52.277 5.915	21 44 45.30 112.28	.26	.80229 6287	18 09
June 3	10 40 58.192 7.744	21 42 53.02 121.58	.26	.86516 6217	17 53
7	10 41 05.936 +9.541	+21 40 51.44 -130.35	0.26	33.92733 +6122	17 37
11	10 41 15.477 11.305	21 38 41.09 138.60	.26	33.98855 5999	17 22
15	10 41 26.782 13.040	21 36 22.49 146.33	.26	34.04854 5852	17 06
19	10 41 39.822 14.737	21 33 56.16 153.47	.26	.10706 5677	16 51
23	10 41 54.559 16.384	21 31 22.69 159.97	.26	.16383 5475	16 35
27	10 42 10.943 +17.967	+21 28 42.72 -165.81	0.26	34.21858 +5247	16 20
July 1	10 42 28.910	+21 25 56.91	0.26	34.27105	16 04

Double transit, March 3

PLUTO, 1960

FOR 0^h EPHEMERIS TIME

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Date		Astrometric Right Ascension 1950.0	Astrometric Declination 1950.0	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
		^h ^m ^s	[°] ['] ["]	["]		^h ^m
July	1	10 42 28.910	+21 25 56.91	0.26	34.27105	16 04
	5	10 42 48.391	21 23 05.96	.26	.32099	15 49
	9	10 43 09.309	21 20 10.54	.26	.36822	15 34
	13	10 43 31.595	21 17 11.26	.26	.41254	15 18
	17	10 43 55.179	21 14 08.76	.26	.45375	15 03
	21	10 44 19.988	+21 11 03.71	0.26	34.49167	14 48
	25	10 44 45.936	21 07 56.82	.25	.52610	14 32
	29	10 45 12.930	21 04 48.84	.25	.55687	14 17
	Aug. 2	10 45 40.868	21 01 40.49	.25	.58384	14 02
	6	10 46 09.651	20 58 32.48	.25	.60690	13 47
	10	10 46 39.183	+20 55 25.44	0.25	34.62596	13 31
	14	10 47 09.374	20 52 20.04	.25	.64092	13 16
	18	10 47 40.127	20 49 16.97	.25	.65169	13 01
	22	10 48 11.339	20 46 16.94	.25	.65818	12 46
	26	10 48 42.895	20 43 20.68	.25	.66034	12 30
	30	10 49 14.682	+20 40 28.91	0.25	34.65814	12 15
	Sept. 3	10 49 46.584	20 37 42.27	.25	.65158	12 00
	7	10 50 18.498	20 35 01.38	.25	.64069	11 45
	11	10 50 50.322	20 32 26.83	.25	.62550	11 30
	15	10 51 21.951	20 29 59.25	.25	.60601	11 14
	19	10 51 53.273	+20 27 39.30	0.25	34.58228	10 59
	23	10 52 24.170	20 25 27.61	.25	.55438	10 44
	27	10 52 54.524	20 23 24.75	.25	.52239	10 29
	Oct. 1	10 53 24.223	20 21 31.27	.26	.48646	10 13
	5	10 53 53.164	20 19 47.62	.26	.44673	9 58
	9	10 54 21.249	+20 18 14.25	0.26	34.40336	9 43
	13	10 54 48.381	20 16 51.61	.26	.35648	9 28
	17	10 55 14.454	20 15 40.17	.26	.30627	9 12
	21	10 55 39.363	20 14 40.32	.26	.25292	8 57
	25	10 56 03.003	20 13 52.42	.26	.19665	8 42
	29	10 56 25.280	+20 13 16.72	0.26	34.13772	8 26
	Nov. 2	10 56 46.114	20 12 53.39	.26	.07640	8 11
	6	10 57 05.433	20 12 42.60	.26	34.01294	7 56
	10	10 57 23.162	20 12 44.44	.26	33.94759	7 40
	14	10 57 39.228	20 12 59.04	.26	.88064	7 25
	18	10 57 53.558	+20 13 26.41	0.26	33.81237	7 09
	22	10 58 06.086	20 14 06.53	.26	.74310	6 54
	26	10 58 16.763	20 14 59.20	.26	.67317	6 38
	30	10 58 25.555	20 16 04.17	.26	.60293	6 23
	Dec. 4	10 58 32.438	20 17 21.13	.26	.53268	6 07
	8	10 58 37.390	+20 18 49.76	0.26	33.46275	5 51
	12	10 58 40.393	20 20 29.67	.26	.39345	5 36
	16	10 58 41.434	20 22 20.42	.26	.32511	5 20
	20	10 58 40.513	20 24 21.46	.26	.25807	5 04
	24	10 58 37.646	20 26 32.11	.27	.19269	4 48
	28	10 58 32.871	+20 28 51.63	0.27	33.12930	4 33
	32	10 58 26.234	+20 31 19.24	0.27	33.06820	4 17

CERES, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
Mar. 6	^{h m s} 20 31 47.28	^{m s} +0 34.61	^{° ' "} -23 30 22.6	^{' "} +2 09.6	2.45	3.598 214	^{h m s} 9 36 30
7	20 33 20.65	34.60	23 27 09.7	2 10.7	2.45	.589 671	9 34 07
8	20 34 53.62	34.58	23 23 56.0	2 11.8	2.46	.581 013	9 31 44
9	20 36 26.21	34.56	23 20 41.7	2 12.9	2.46	.572 241	9 29 20
10	20 37 58.40	34.54	23 17 26.9	2 13.9	2.47	.563 357	9 26 55
11	20 39 30.19	+0 34.52	-23 14 11.6	+2 14.9	2.48	3.554 360	9 24 31
12	20 41 01.58	34.50	23 10 55.8	2 16.0	2.48	.545 254	9 22 06
13	20 42 32.56	34.48	23 07 39.7	2 17.0	2.49	.536 038	9 19 40
14	20 44 03.13	34.45	23 04 23.4	2 18.0	2.50	.526 713	9 17 14
15	20 45 33.28	34.43	23 01 06.9	2 19.0	2.50	.517 282	9 14 48
16	20 47 03.01	+0 34.40	-22 57 50.3	+2 20.0	2.51	3.507 743	9 12 21
17*	20 48 32.33	34.38	22 54 33.7	2 21.0	2.52	.498 098	9 09 54
18	20 50 01.21	34.36	22 51 17.2	2 22.1	2.52	.488 348	9 07 26
19	20 51 29.66	34.35	22 48 00.8	2 23.1	2.53	.478 494	9 04 58
20	20 52 57.67	34.34	22 44 44.8	2 24.1	2.54	.468 535	9 02 30
21	20 54 25.23	+0 34.32	-22 41 29.0	+2 25.1	2.55	3.458 475	9 00 01
22	20 55 52.35	34.31	22 38 13.8	2 26.1	2.55	.448 313	8 57 31
23	20 57 19.00	34.30	22 34 59.1	2 27.0	2.56	.438 051	8 55 02
24	20 58 45.19	34.28	22 31 45.0	2 27.9	2.57	.427 689	8 52 31
25	21 00 10.91	34.26	22 28 31.6	2 28.8	2.58	.417 230	8 50 01
26	21 01 36.15	+0 34.24	-22 25 19.1	+2 29.7	2.58	3.406 673	8 47 29
27	21 03 00.90	34.22	22 22 07.5	2 30.6	2.59	.396 022	8 44 58
28	21 04 25.16	34.20	22 18 56.9	2 31.6	2.60	.385 278	8 42 25
29	21 05 48.92	34.18	22 15 47.4	2 32.5	2.61	.374 442	8 39 53
30*	21 07 12.18	34.16	22 12 39.1	2 33.4	2.62	.363 516	8 37 19
31	21 08 34.92	+0 34.14	-22 09 32.1	+2 34.3	2.63	3.352 502	8 34 46
Apr. 1	21 09 57.15	+0 34.12	-22 06 26.5	+2 35.2	2.63	3.341 402	8 32 11

Magnitude : Mar. 7, 9.1 ; Mar. 27, 9.0

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephe- meris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Apr. 1	^{h m s} 21 09 57.15 + ^s 81.70	^{m s} +0 34.12	^{° ' " s} -22 06 26.5 +184.2	^{' " s} +2 35.2	2.63	3.341 402	^{h m s} 8 32 11
2	21 11 18.85 + 81.18	34.11	22 03 22.3 +182.6	2 36.1	2.64	330 216	8 29 37
3	21 12 40.03 + 80.65	34.10	22 00 19.7 +181.0	2 37.0	2.65	318 948	8 27 01
4	21 14 00.68 + 80.10	34.09	21 57 18.7 +179.2	2 37.8	2.66	307 598	8 24 26
5	21 15 20.78 + 79.56	34.08	21 54 19.5 +177.4	2 38.7	2.67	296 168	8 21 49
6	21 16 40.34 + 79.02	+0 34.07	-21 51 22.1 +175.5	+2 39.5	2.68	3.284 661	8 19 12
7	21 17 59.36 + 78.46	34.06	21 48 26.6 +173.4	2 40.3	2.69	273 076	8 16 35
8	21 19 17.82 + 77.90	34.04	21 45 33.2 +171.4	2 41.1	2.70	261 417	8 13 57
9	21 20 35.72 + 77.34	34.03	21 42 41.8 +169.1	2 41.9	2.71	249 684	8 11 18
10	21 21 53.06 + 76.77	34.01	21 39 52.7 +166.9	2 42.7	2.72	237 880	8 08 39
11	21 23 09.83 + 76.20	+0 34.00	-21 37 05.8 +164.5	+2 43.5	2.73	3.226 005	8 05 59
12	21 24 26.03 + 75.61	33.98	21 34 21.3 +162.0	2 44.2	2.74	214 062	8 03 19
13	21 25 41.64 + 75.04	33.96	21 31 39.3 +159.3	2 45.0	2.75	202 050	8 00 38
14*	21 26 56.68 + 74.44	33.96	21 29 00.0 +156.7	2 45.9	2.76	189 972	7 57 57
15	21 28 11.12 + 73.84	33.95	21 26 23.3 +153.9	2 46.7	2.77	177 829	7 55 15
16	21 29 24.96 + 73.23	+0 33.94	-21 23 49.4 +151.0	+2 47.4	2.78	3.165 622	7 52 32
17	21 30 38.19 + 72.62	33.94	21 21 18.4 +147.9	2 48.2	2.79	153 352	7 49 49
18	21 31 50.81 + 71.99	33.94	21 18 50.5 +144.8	2 49.0	2.80	141 021	7 47 05
19	21 33 02.80 + 71.36	33.94	21 16 25.7 +141.6	2 49.7	2.81	128 631	7 44 21
20	21 34 14.16 + 70.71	33.93	21 14 04.1 +138.2	2 50.5	2.82	116 182	7 41 36
21	21 35 24.87 + 70.06	+0 33.92	-21 11 45.9 +134.8	+2 51.1	2.84	3.103 678	7 38 50
22	21 36 34.93 + 69.40	33.92	21 09 31.1 +131.1	2 51.8	2.85	091 119	7 36 04
23	21 37 44.33 + 68.73	33.91	21 07 20.0 +127.5	2 52.5	2.86	078 508	7 33 17
24	21 38 53.06 + 68.05	33.89	21 05 12.5 +123.7	2 53.2	2.87	065 847	7 30 29
25	21 40 01.11 + 67.35	33.89	21 03 08.8 +119.9	2 53.9	2.88	053 138	7 27 40
26	21 41 08.46 + 66.66	+0 33.88	-21 01 08.9 +115.8	+2 54.5	2.90	3.040 383	7 24 51
27*	21 42 15.12 + 65.95	33.87	20 59 13.1 +111.7	2 55.2	2.91	027 584	7 22 02
28	21 43 21.07 + 65.23	33.87	20 57 21.4 +107.5	2 55.9	2.92	014 744	7 19 11
29	21 44 26.30 + 64.51	33.87	20 55 33.9 +103.2	2 56.6	2.93	3.001 865	7 16 20
30	21 45 30.81 + 63.77	33.87	20 53 50.7 +98.8	2 57.3	2.95	2.988 949	7 13 28
May 1	21 46 34.58 + 63.03	+0 33.87	-20 52 11.9 +94.2	+2 57.9	2.96	2.975 999	7 10 35
2	21 47 37.61 + 62.28	33.88	20 50 37.7 +89.7	2 58.6	2.97	963 017	7 07 42
3	21 48 39.89 + 61.52	33.88	20 49 08.0 +84.9	2 59.2	2.98	950 005	7 04 48
4	21 49 41.41 + 60.76	33.88	20 47 43.1 +80.1	2 59.8	3.00	936 965	7 01 53
5	21 50 42.17 + 59.98	33.88	20 46 23.0 +75.3	3 00.4	3.01	923 900	6 58 57
6	21 51 42.15 + 59.19	+0 33.88	-20 45 07.7 +70.2	+3 01.0	3.02	2.910 812	6 56 01
7	21 52 41.34 + 58.40	33.88	20 43 57.5 +65.0	3 01.5	3.04	897 703	6 53 03
8	21 53 39.74 + 57.60	33.88	20 42 52.5 +59.9	3 02.1	3.05	884 575	6 50 05
9	21 54 37.34 + 56.80	33.88	20 41 52.6 +54.5	3 02.6	3.07	871 430	6 47 07
10	21 55 34.14 + 55.97	33.88	20 40 58.1 +49.2	3 03.2	3.08	858 271	6 44 07
11*	21 56 30.11 + 55.15	+0 33.88	-20 40 08.9 +43.6	+3 03.8	3.09	2.845 100	6 41 07
12	21 57 25.26 + 54.30	33.89	20 39 25.3 +37.9	3 04.4	3.11	831 917	6 38 05
13	21 58 19.56 + 53.46	33.90	20 38 47.4 +32.2	3 05.0	3.12	818 726	6 35 03
14	21 59 13.02 + 52.60	33.92	20 38 15.2 +26.3	3 05.5	3.14	805 528	6 32 00
15	22 00 05.62 + 51.72	33.93	20 37 48.9 +20.4	3 06.1	3.15	792 325	6 28 57
16	22 00 57.34 + 50.83	+0 33.94	-20 37 28.5 +14.2	+3 06.7	3.17	2.779 120	6 25 52
17	22 01 48.17 + 50.00	+0 33.95	-20 37 14.3 +14.2	+3 07.2	3.18	2.765 915	6 22 46

Magnitude: Apr. 16, 8.8; May 6, 8.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
May 17	22 01 48.17 + 49.93	+0 33.95	-20 37 14.3 + 8.1	+3 07.2	3.18	2.765 915	6 22 46
18	22 02 38.10 + 49.02	33.96	20 37 06.2 + 1.8	3 07.6	3.20	.752 712	6 19 40
19	22 03 27.12 + 48.08	33.97	20 37 04.4 - 4.7	3 08.1	3.21	.739 513	6 16 33
20	22 04 15.20 + 47.15	33.98	20 37 09.1 11.2	3 08.6	3.23	.726 322	6 13 24
21	22 05 02.35 + 46.19	33.99	20 37 20.3 17.8	3 09.0	3.24	.713 141	6 10 15
22	22 05 48.54 + 45.21	+0 33.99	-20 37 38.1 - 24.5	+3 09.5	3.26	2.699 974	6 07 05
23	22 06 33.75 + 44.24	34.00	20 38 02.6 31.4	3 10.0	3.28	.686 822	6 03 54
24	22 07 17.99 + 43.24	34.01	20 38 34.0 38.2	3 10.5	3.29	.673 690	6 00 42
25*	22 08 01.23 + 42.23	34.03	20 39 12.2 45.3	3 10.9	3.31	.660 580	5 57 28
26	22 08 43.46 + 41.21	34.04	20 39 57.5 52.3	3 11.4	3.32	.647 496	5 54 14
27	22 09 24.67 + 40.17	+0 34.06	-20 40 49.8 - 59.4	+3 11.9	3.34	2.634 440	5 50 59
28	22 10 04.84 + 39.13	34.08	20 41 49.2 66.7	3 12.3	3.36	.621 416	5 47 43
29	22 10 43.97 + 38.07	34.10	20 42 55.9 74.0	3 12.8	3.37	.608 426	5 44 26
30	22 11 22.04 + 37.00	34.12	20 44 09.9 81.4	3 13.2	3.39	.595 475	5 41 07
31	22 11 59.04 + 35.91	34.14	20 45 31.3 88.8	3 13.6	3.41	.582 565	5 37 48
June 1	22 12 34.95 + 34.82	+0 34.16	-20 47 00.1 - 96.4	+3 14.0	3.43	2.569 699	5 34 28
2	22 13 09.77 + 33.72	34.18	20 48 36.5 103.8	3 14.3	3.44	.556 881	5 31 06
3	22 13 43.49 + 32.60	34.20	20 50 20.3 111.6	3 14.7	3.46	.544 114	5 27 44
4	22 14 16.09 + 31.47	34.21	20 52 11.9 119.2	3 15.0	3.48	.531 401	5 24 20
5	22 14 47.56 + 30.32	34.23	20 54 11.1 126.9	3 15.4	3.49	.518 745	5 20 55
6	22 15 17.88 + 29.18	+0 34.25	-20 56 18.0 - 134.7	+3 15.7	3.51	2.506 149	5 17 29
7	22 15 47.06 + 28.01	34.27	20 58 32.7 142.6	3 16.1	3.53	.493 615	5 14 02
8*	22 16 15.07 + 26.84	34.29	21 00 55.3 150.4	3 16.5	3.55	.481 148	5 10 34
9	22 16 41.91 + 25.65	34.32	21 03 25.7 158.4	3 16.8	3.57	.468 750	5 07 04
10	22 17 07.56 + 24.45	34.35	21 06 04.1 166.4	3 17.2	3.58	.456 423	5 03 34
11	22 17 32.01 + 23.23	+0 34.38	-21 08 50.5 - 174.3	+3 17.6	3.60	2.444 171	5 00 02
12	22 17 55.24 + 21.99	34.42	21 11 44.8 182.4	3 17.9	3.62	.431 997	4 56 29
13	22 18 17.23 + 20.75	34.45	21 14 47.2 190.5	3 18.2	3.64	.419 904	4 52 55
14	22 18 37.98 + 19.49	34.48	21 17 57.7 198.7	3 18.5	3.66	.407 895	4 49 19
15	22 18 57.47 + 18.21	34.51	21 21 16.4 206.7	3 18.8	3.67	.395 974	4 45 42
16	22 19 15.68 + 16.92	+0 34.53	-21 24 43.1 - 215.0	+3 19.0	3.69	2.384 145	4 42 04
17	22 19 32.60 + 15.61	34.56	21 28 18.1 223.0	3 19.2	3.71	.372 411	4 38 25
18	22 19 48.21 + 14.30	34.58	21 32 01.1 231.2	3 19.5	3.73	.360 775	4 34 44
19	22 20 02.51 + 12.96	34.61	21 35 52.3 239.2	3 19.7	3.75	.349 243	4 31 03
20	22 20 15.47 + 11.62	34.64	21 39 51.5 247.4	3 19.9	3.77	.337 818	4 27 19
21*	22 20 27.09 + 10.26	+0 34.67	-21 43 58.9 - 255.3	+3 20.2	3.78	2.326 504	4 23 35
22	22 20 37.35 + 8.90	34.71	21 48 14.2 263.4	3 20.4	3.80	.315 306	4 19 49
23	22 20 46.25 + 7.52	34.75	21 52 37.6 271.2	3 20.7	3.82	.304 226	4 16 02
24	22 20 53.77 + 6.14	34.78	21 57 08.8 279.1	3 20.9	3.84	.293 270	4 12 13
25	22 20 59.91 + 4.74	34.82	22 01 47.9 286.8	3 21.1	3.86	.282 442	4 08 23
26	22 21 04.65 + 3.34	+0 34.86	-22 06 34.7 - 294.5	+3 21.3	3.87	2.271 745	4 04 31
27	22 21 07.99 + 1.94	34.90	22 11 29.2 302.1	3 21.4	3.89	.261 184	4 00 39
28	22 21 09.93 + 0.53	34.94	22 16 31.3 309.5	3 21.6	3.91	.250 762	3 56 45
29	22 21 10.46 + 0.89	34.98	22 21 40.8 316.8	3 21.7	3.93	.240 485	3 52 49
30	22 21 09.57 + 2.31	35.02	22 26 57.6 324.0	3 21.8	3.95	.230 355	3 48 52
July 1	22 21 07.26 + 3.74	+0 35.05	-22 32 21.6 - 331.0	+3 21.9	3.96	2.220 377	3 44 54
2	22 21 03.52 + 3.74	+0 35.09	-22 37 52.6 - 331.0	+3 22.0	3.98	2.210 555	3 40 54

Magnitude : May 26, 8.5 ; June 15, 8.3

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
	h m s	m s	° ' "	' "			h m s
July 1	22 21 07.26	+0 35.05	-22 32 21.6	+3 21.9	3.96	2.220 377	3 44 54
2	22 21 03.52	35.09	22 37 52.6	3 22.0	3.98	210 555	3 40 54
3	22 20 58.36	35.13	22 43 30.5	3 22.1	4.00	200 892	3 36 53
4	22 20 51.78	35.17	22 49 15.1	3 22.1	4.02	191 393	3 32 50
5	22 20 43.77	35.21	22 55 06.2	3 22.2	4.03	182 060	3 28 46
6*	22 20 34.33	+0 35.25	-23 01 03.8	+3 22.3	4.05	2.172 897	3 24 40
7	22 20 23.47	35.30	23 07 07.4	3 22.4	4.07	163 909	3 20 34
8	22 20 11.18	35.36	23 13 17.1	3 22.5	4.08	155 097	3 16 25
9	22 19 57.46	35.41	23 19 32.6	3 22.6	4.10	146 467	3 12 16
10	22 19 42.33	35.46	23 25 53.6	3 22.6	4.12	138 021	3 08 04
11	22 19 25.76	+0 35.51	-23 32 20.0	+3 22.6	4.13	2.129 763	3 03 52
12	22 19 07.78	35.56	23 38 51.5	3 22.5	4.15	121 696	2 59 38
13	22 18 48.39	35.61	23 45 27.8	3 22.5	4.16	113 825	2 55 23
14	22 18 27.58	35.65	23 52 08.7	3 22.4	4.18	106 154	2 51 06
15	22 18 05.36	35.70	23 58 54.0	3 22.3	4.19	098 686	2 46 48
16	22 17 41.75	+0 35.74	-24 05 43.2	+3 22.3	4.21	2.091 425	2 42 28
17	22 17 16.76	35.79	24 12 36.1	3 22.2	4.22	084 375	2 38 08
18	22 16 50.39	35.84	24 19 32.5	3 22.1	4.24	077 541	2 33 45
19*	22 16 22.66	35.90	24 26 31.8	3 22.0	4.25	070 926	2 29 22
20	22 15 53.59	35.95	24 33 33.8	3 21.9	4.26	064 533	2 24 57
21	22 15 23.20	+0 36.01	-24 40 38.2	+3 21.8	4.28	2.058 367	2 20 31
22	22 14 51.51	36.06	24 47 44.4	3 21.7	4.29	052 432	2 16 03
23	22 14 18.54	36.12	24 54 52.3	3 21.5	4.30	046 730	2 11 34
24	22 13 44.32	36.18	25 02 01.3	3 21.3	4.31	041 265	2 07 04
25	22 13 08.88	36.23	25 09 11.1	3 21.1	4.32	036 040	2 02 33
26	22 12 32.24	+0 36.29	-25 16 21.2	+3 20.9	4.33	2.031 058	1 58 01
27	22 11 54.43	36.34	25 23 31.3	3 20.6	4.34	026 323	1 53 27
28	22 11 15.49	36.39	25 30 40.9	3 20.4	4.35	021 837	1 48 53
29	22 10 35.46	36.44	25 37 49.7	3 20.1	4.36	017 602	1 44 17
30	22 09 54.37	36.50	25 44 57.1	3 19.8	4.37	013 621	1 39 40
31	22 09 12.26	+0 36.54	-25 52 02.8	+3 19.5	4.38	2.009 896	1 35 02
Aug. 1	22 08 29.17	36.60	25 59 06.4	3 19.2	4.39	006 430	1 30 24
2*	22 07 45.14	36.66	26 06 07.4	3 19.0	4.39	003 223	1 25 44
3	22 07 00.21	36.71	26 13 05.4	3 18.7	4.40	2.000 278	1 21 03
4	22 06 14.43	36.78	26 20 00.1	3 18.4	4.41	1.997 596	1 16 22
5	22 05 27.83	+0 36.84	-26 26 51.0	+3 18.1	4.41	1.995 178	1 11 40
6	22 04 40.47	36.90	26 33 37.7	3 17.7	4.42	993 026	1 06 57
7	22 03 52.39	36.96	26 40 19.9	3 17.3	4.42	991 141	1 02 13
8	22 03 03.63	37.02	26 46 57.1	3 17.0	4.42	989 524	0 57 29
9	22 02 14.25	37.07	26 53 28.9	3 16.5	4.43	988 176	0 52 44
10	22 01 24.28	+0 37.12	-26 59 55.1	+3 16.1	4.43	1.987 098	0 47 58
11	22 00 33.77	37.17	27 06 15.1	3 15.6	4.43	986 291	0 43 12
12	21 59 42.79	37.22	27 12 28.7	3 15.2	4.43	985 757	0 38 26
13	21 58 51.38	37.27	27 18 35.4	3 14.7	4.43	985 496	0 33 39
14*	21 57 59.59	37.32	27 24 34.9	3 14.3	4.43	985 509	0 28 51
15	21 57 07.49	+0 37.37	-27 30 26.8	+3 13.9	4.43	1.985 797	0 24 04
16	21 56 15.13	+0 37.42	-27 36 10.8	+3 13.4	4.43	1.986 360	0 19 16

Magnitude: July 5, 8.1; July 25, 7.9; Aug. 14, 7.9

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Aug. 16	21 56 15.13 - 52.57	+0 37.42	-27 36 10.8 - 335.8	+3 13.4 4.43	1.986 360	0 19 16	
17	21 55 22.56 - 52.70	37.48	27 41 46.6 - 327.1	3 12.9 4.43	.987 198	0 14 28	
18	21 54 29.86 - 52.79	37.53	27 47 13.7 - 318.3	3 12.5 4.43	.988 311	0 09 40	
19	21 53 37.07 - 52.81	37.58	27 52 32.0 - 309.1	3 12.0 4.42	.989 699	0 04 51	
20	21 52 44.26 - 52.78	37.63	27 57 41.1 - 299.6	3 11.5 4.42	.991 362	{ 0 00 03 } { 23 55 14 }	
21	21 51 51.48 - 52.67	+0 37.68	-28 02 40.7 - 289.9	+3 11.0 4.42	1.993 298	23 50 26	
22	21 50 58.81 - 52.51	37.73	28 07 30.6 - 279.9	3 10.5 4.41	.995 508	23 45 38	
23	21 50 06.30 - 52.28	37.77	28 12 10.5 - 269.7	3 09.9 4.41	1.997 990	23 40 50	
24	21 49 14.02 - 52.00	37.81	28 16 40.2 - 259.4	3 09.4 4.40	2.000 743	23 36 03	
25	21 48 22.02 - 51.66	37.84	28 20 59.6 - 248.7	3 08.8 4.39	.003 765	23 31 16	
26	21 47 30.36 - 51.25	+0 37.88	-28 25 08.3 - 237.9	+3 08.3 4.39	2.007 055	23 26 29	
27	21 46 39.11 - 50.79	37.91	28 29 06.2 - 227.1	3 07.7 4.38	.010 611	23 21 42	
28	21 45 48.32 - 50.26	37.95	28 32 53.3 - 216.0	3 07.2 4.37	.014 431	23 16 57	
29*	21 44 58.06 - 49.69	37.98	28 36 29.3 - 204.9	3 06.7 4.36	.018 512	23 12 11	
30	21 44 08.37 - 49.07	38.02	28 39 54.2 - 193.6	3 06.2 4.35	.022 853	23 07 27	
31	21 43 19.30 - 48.38	+0 38.06	-28 43 07.8 - 182.4	+3 05.7 4.34	2.027 449	23 02 43	
Sept. 1	21 42 30.92 - 47.65	38.10	28 46 10.2 - 171.0	3 05.2 4.33	.032 299	22 57 59	
2	21 41 43.27 - 46.87	38.13	28 49 01.2 - 159.6	3 04.7 4.32	.037 400	22 53 17	
3	21 40 56.40 - 46.05	38.17	28 51 40.8 - 148.1	3 04.2 4.31	.042 749	22 48 35	
4	21 40 10.35 - 45.18	38.20	28 54 08.9 - 136.8	3 03.7 4.30	.048 343	22 43 54	
5	21 39 25.17 - 44.28	+0 38.22	-28 56 25.7 - 125.3	+3 03.1 4.28	2.054 179	22 39 14	
6	21 38 40.89 - 43.32	38.24	28 58 31.0 - 114.0	3 02.6 4.27	.060 254	22 34 35	
7	21 37 57.57 - 42.32	38.26	29 00 25.0 - 102.5	3 02.1 4.26	.066 567	22 29 57	
8	21 37 15.25 - 41.30	38.28	29 02 07.5 - 91.2	3 01.6 4.25	.073 113	22 25 20	
9	21 36 33.95 - 40.23	38.29	29 03 38.7 - 79.8	3 01.1 4.23	.079 890	22 20 45	
10*	21 35 53.72 - 39.12	+0 38.31	-29 04 58.5 - 68.5	+3 00.6 4.22	2.086 895	22 16 10	
11	21 35 14.60 - 37.98	38.32	29 06 07.0 - 57.3	3 00.2 4.20	.094 125	22 11 36	
12	21 34 36.62 - 36.80	38.34	29 07 04.3 - 46.1	2 59.7 4.19	.101 577	22 07 03	
13	21 33 59.82 - 35.59	38.35	29 07 50.4 - 35.0	2 59.3 4.17	.109 248	22 02 32	
14	21 33 24.23 - 34.35	38.37	29 08 25.4 - 23.9	2 58.9 4.16	.117 135	21 58 02	
15	21 32 49.88 - 33.07	+0 38.38	-29 08 49.3 - 13.1	+2 58.4 4.14	2.125 233	21 53 33	
16	21 32 16.81 - 31.77	38.39	29 09 02.4 - 2.2	2 58.0 4.13	.133 541	21 49 05	
17	21 31 45.04 - 30.44	38.40	29 09 04.6 - 8.5	2 57.6 4.11	.142 052	21 44 39	
18	21 31 14.60 - 29.09	38.40	29 08 56.1 - 19.1	2 57.2 4.09	.150 766	21 40 14	
19	21 30 45.51 - 27.71	38.40	29 08 37.0 - 29.6	2 56.8 4.08	.159 676	21 35 51	
20	21 30 17.80 - 26.30	+0 38.40	-29 08 07.4 - 39.9	+2 56.4 4.06	2.168 781	21 31 28	
21	21 29 51.50 - 24.89	38.39	29 07 27.5 - 50.2	2 56.0 4.04	.178 074	21 27 08	
22	21 29 26.61 - 23.45	38.39	29 06 37.3 - 60.2	2 55.6 4.02	.187 553	21 22 48	
23	21 29 03.16 - 21.99	38.38	29 05 37.1 - 70.1	2 55.3 4.01	.197 213	21 18 30	
24	21 28 41.17 - 20.53	38.37	29 04 27.0 - 79.9	2 55.0 3.99	.207 051	21 14 14	
25*	21 28 20.64 - 19.04	+0 38.36	-29 03 07.1 - 89.5	+2 54.7 3.97	2.217 060	21 09 59	
26	21 28 01.60 - 17.56	38.35	29 01 37.6 - 98.9	2 54.4 3.95	.227 238	21 05 45	
27	21 27 44.04 - 16.06	38.34	28 59 58.7 - 108.1	2 54.2 3.93	.237 580	21 01 33	
28	21 27 27.98 - 14.56	38.34	28 58 10.6 - 117.2	2 54.0 3.92	.248 080	20 57 23	
29	21 27 13.42 - 13.06	38.33	28 56 13.4 - 126.1	2 53.8 3.90	.258 736	20 53 13	
30	21 27 00.36 - 11.55	+0 38.32	-28 54 07.3 - 134.9	+2 53.6 3.88	2.269 542	20 49 06	
Oct. 1	21 26 48.81 - 10.44	+0 38.31	-28 51 52.4 - 144.9	+2 53.3 3.86	2.280 495	20 45 00	

Magnitude : Sept. 3, 7.9 ; Sept. 23, 8.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1960

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Oct. 1	^{h m s} 21 26 48.81	^s -10.06	^{° ' " "} -28 51 52.4	^{" "} +143.4	3.86	2.280 495	^{h m s} 20 45 00
2	21 26 38.75	8.55	28 49 29.0	2 53.1	3.84	2.291 590	20 40 55
3	21 26 30.20	7.05	28 46 57.1	2 52.9	3.82	3.02 824	20 36 52
4	21 26 23.15	5.56	28 44 17.0	2 52.7	3.80	3.14 192	20 32 50
5	21 26 17.59	4.07	28 41 28.8	2 52.5	3.78	3.25 691	20 28 50
6	21 26 13.52	2.59	28 38 32.7	2 52.4	3.77	2.337 317	20 24 51
7	21 26 10.93	1.11	28 35 28.9	2 52.3	3.75	3.49 066	20 20 54
8*	21 26 09.82	0.37	28 32 17.3	2 52.2	3.73	3.60 936	20 16 58
9	21 26 10.19	1.84	28 28 58.3	2 52.2	3.71	3.72 921	20 13 04
10	21 26 12.03	3.30	28 25 31.9	2 52.1	3.69	3.85 020	20 09 11
11	21 26 15.33	4.75	28 21 58.2	2 52.1	3.67	2.397 228	20 05 20
12	21 26 20.08	6.20	28 18 17.5	2 52.1	3.65	4.09 541	20 01 30
13	21 26 26.28	7.64	28 14 29.8	2 52.0	3.63	4.21 956	19 57 41
14	21 26 33.92	9.07	28 10 35.2	2 52.0	3.62	4.34 469	19 53 54
15	21 26 42.99	10.49	28 06 33.9	2 52.0	3.60	4.47 077	19 50 08
16	21 26 53.48	11.90	28 02 26.1	2 52.0	3.58	2.459 775	19 46 24
17	21 27 05.38	13.29	27 58 11.8	2 52.0	3.56	4.72 561	19 42 41
18	21 27 18.67	14.69	27 53 51.1	2 52.1	3.54	4.85 429	19 38 59
19	21 27 33.36	16.07	27 49 24.2	2 52.1	3.52	4.98 377	19 35 19
20	21 27 49.43	17.42	27 44 51.2	2 52.2	3.51	5.11 401	19 31 40
21	21 28 06.85	18.79	27 40 12.2	2 52.3	3.49	2.524 496	19 28 03
22*	21 28 25.64	20.11	27 35 27.4	2 52.4	3.47	5.37 659	19 24 27
23	21 28 45.75	21.44	27 30 36.8	2 52.6	3.45	5.50 886	19 20 52
24	21 29 07.19	22.74	27 25 40.6	2 52.7	3.43	5.64 173	19 17 18
25	21 29 29.93	24.03	27 20 38.9	2 52.9	3.42	5.77 516	19 13 46
26	21 29 53.96	25.30	27 15 31.7	2 53.1	3.40	2.590 911	19 10 15
27	21 30 19.26	26.55	27 10 19.3	2 53.3	3.38	6.04 355	19 06 45
28	21 30 45.81	27.78	27 05 01.7	2 53.5	3.36	6.17 844	19 03 16
29	21 31 13.59	29.00	26 59 39.0	2 53.6	3.35	6.31 375	18 59 49
30	21 31 42.59	30.19	26 54 11.3	2 53.8	3.33	6.44 945	18 56 23
31	21 32 12.78	31.37	26 48 38.7	2 54.0	3.31	2.658 550	18 52 58
Nov. 1	21 32 44.15	32.52	26 43 01.3	2 54.2	3.29	6.72 187	18 49 34
2	21 33 16.67	33.66	26 37 19.1	2 54.5	3.28	6.85 854	18 46 11
3	21 33 50.33	34.79	26 31 32.3	2 54.7	3.26	6.99 547	18 42 50
4*	21 34 25.12	35.89	26 25 40.9	2 55.0	3.24	7.13 265	18 39 29
5	21 35 01.01	36.98	26 19 45.0	2 55.3	3.23	2.727 003	18 36 10
6	21 35 37.99	38.05	26 13 44.7	2 55.6	3.21	7.40 761	18 32 52
7	21 36 16.04	39.11	26 07 39.9	2 55.9	3.20	7.54 534	18 29 34
8	21 36 55.15	40.14	26 01 30.8	2 56.2	3.18	7.68 320	18 26 18
9	21 37 35.29	41.17	25 55 17.5	2 56.6	3.16	7.82 117	18 23 03
10	21 38 16.46	42.18	25 49 00.0	2 56.9	3.15	2.795 921	18 19 49
11	21 38 58.64	43.18	25 42 38.3	2 57.2	3.13	8.09 730	18 16 35
12	21 39 41.82	44.15	25 36 12.5	2 57.5	3.12	8.23 542	18 13 23
13	21 40 25.97	45.11	25 29 42.6	2 57.8	3.10	8.37 353	18 10 12
14	21 41 11.08	46.07	25 23 08.8	2 58.2	3.09	8.51 161	18 07 01
15	21 41 57.15	46.99	25 16 31.0	2 58.5	3.07	2.864 963	18 03 52
16	21 42 44.14		25 09 49.3	2 58.8	3.06	2.878 756	18 00 44

Magnitude: Oct. 13, 8.3; Nov. 2, 8.5

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Nov. 16	21 42 44.14 ^s	+0 36.55	-25 09 49.3	+2 58.8	3.06	2.878 756	18 00 44
17	21 43 32.06 ^s	36.49	25 03 03.8 ^s	2 59.2	3.04	.892 537	17 57 36
18	21 44 20.88	36.44	24 56 14.5	2 59.6	3.03	.906 303	17 54 29
19*	21 45 10.58	36.39	24 49 21.5	3 00.0	3.01	.920 052	17 51 23
20	21 46 01.16	36.35	24 42 24.8	3 00.4	3.00	.933 780	17 48 18
21	21 46 52.59	+0 36.31	-24 35 24.4	+3 00.9	2.99	2.947 484	17 45 14
22	21 47 44.86 ^s	36.26	24 28 20.5	3 01.3	2.97	.961 163	17 42 11
23	21 48 37.96	36.22	24 21 13.1	3 01.7	2.96	.974 812	17 39 08
24	21 49 31.86	36.17	24 14 02.2	3 02.1	2.95	2.988 429	17 36 07
25	21 50 26.55	36.13	24 06 47.9	3 02.5	2.93	3.002 012	17 33 06
26	21 51 22.01 ^s	+0 36.08	-23 59 30.3	+3 02.9	2.92	3.015 558	17 30 05
27	21 52 18.22	36.02	23 52 09.3	3 03.3	2.91	.029 066	17 27 06
28	21 53 15.17	35.97	23 44 45.0	3 03.7	2.89	.042 532	17 24 07
29	21 54 12.84	35.91	23 37 17.5	3 04.1	2.88	.055 955	17 21 09
30	21 55 11.22	35.86	23 29 46.9	3 04.5	2.87	.069 334	17 18 12
Dec. 1	21 56 10.30 ^s	+0 35.81	-23 22 13.0	+3 05.0	2.86	3.082 665	17 15 15
2*	21 57 10.05	35.76	23 14 36.1	3 05.4	2.84	.095 948	17 12 19
3	21 58 10.46	35.71	23 06 56.0	3 05.9	2.83	.109 180	17 09 24
4	21 59 11.53	35.67	22 59 12.9	3 06.4	2.82	.122 360	17 06 29
5	22 00 13.24	35.62	22 51 26.8	3 06.8	2.81	.135 486	17 03 35
6	22 01 15.57 ^s	+0 35.58	-22 43 37.6	+3 07.3	2.80	3.148 556	17 00 41
7	22 02 18.51	35.53	22 35 45.5	3 07.7	2.78	.161 568	16 57 48
8	22 03 22.06	35.49	22 27 50.4	3 08.2	2.77	.174 520	16 54 56
9	22 04 26.20	35.44	22 19 52.5	3 08.6	2.76	.187 411	16 52 04
10	22 05 30.92	35.39	22 11 51.6	3 09.0	2.75	.200 238	16 49 13
11	22 06 36.21	+0 35.34	-22 03 47.9	+3 09.5	2.74	3.213 001	16 46 23
12	22 07 42.06 ^s	35.29	21 55 41.4	3 09.9	2.73	.225 696	16 43 33
13	22 08 48.45	35.23	21 47 32.0	3 10.3	2.72	.238 322	16 40 43
14	22 09 55.39	35.18	21 39 19.9	3 10.7	2.71	.250 877	16 37 54
15	22 11 02.85	35.13	21 31 05.1	3 11.2	2.70	.263 359	16 35 06
16*	22 12 10.83 ^s	+0 35.09	-21 22 47.5	+3 11.6	2.69	3.275 765	16 32 18
17	22 13 19.31	35.04	21 14 27.4	3 12.1	2.68	.288 095	16 29 30
18	22 14 28.29	35.00	21 06 04.5	3 12.6	2.67	.300 345	16 26 43
19	22 15 37.76	34.96	20 57 39.1	3 13.1	2.66	.312 513	16 23 57
20	22 16 47.70	34.92	20 49 11.1	3 13.5	2.65	.324 597	16 21 11
21	22 17 58.10	+0 34.88	-20 40 40.6	+3 14.0	2.64	3.336 596	16 18 25
22	22 19 08.95 ^s	34.84	20 32 07.7	3 14.4	2.63	.348 508	16 15 40
23	22 20 20.24	34.80	20 23 32.3	3 14.8	2.62	.360 330	16 12 55
24	22 21 31.96	34.75	20 14 54.5	3 15.3	2.61	.372 062	16 10 11
25	22 22 44.09	34.70	20 06 14.4	3 15.6	2.60	.383 702	16 07 27
26	22 23 56.63	+0 34.65	-19 57 31.9	+3 16.0	2.59	3.395 247	16 04 44
27	22 25 09.56 ^s	34.60	19 48 47.2	3 16.5	2.58	.406 699	16 02 01
28	22 26 22.87	34.56	19 40 00.2	3 16.9	2.58	.418 054	15 59 18
29	22 27 36.56	34.52	19 31 11.1	3 17.3	2.57	.429 312	15 56 36
30*	22 28 50.62	34.47	19 22 19.7	3 17.7	2.56	.440 472	15 53 54
31	22 30 05.03 ^s	+0 34.43	-19 13 26.1	+3 18.2	2.55	3.451 532	15 51 12
32	22 31 19.80	+0 34.40	-19 04 30.5	+3 18.6	2.54	3.462 492	15 48 31

Magnitude : Nov. 22, 8.7 ; Dec. 12, 8.9 ; Dec. 32, 9.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Jan. 30	^{h m s} 18 10 57.25 ^s	^{m s} +0 28.74	^{° ' "} + 5 00 52.7 ["]	^{' "} +0 13.2 ["]	2.32	3.796 850	^{h m s} 9 37 25
31	18 12 18.56 ^s	28.73	5 05 17.0 ["]	0 14.2 ["]	2.32	.791 201	9 34 50
Feb. 1*	18 13 39.48 ^s	28.73	5 09 47.4 ["]	0 15.2 ["]	2.33	.785 446	9 32 15
2	18 15 00.00 ^s	28.72	5 14 23.9 ["]	0 16.2 ["]	2.33	.779 584	9 29 39
3	18 16 20.12 ^s	28.72	5 19 06.4 ["]	0 17.3 ["]	2.33	.773 617	9 27 02
4	18 17 39.81 ^s	+0 28.72	+ 5 23 55.0 ["]	+0 18.3 ["]	2.34	3.767 546	9 24 26
5	18 18 59.09 ^s	28.72	5 28 49.5 ["]	0 19.3 ["]	2.34	.761 372	9 21 49
6	18 20 17.94 ^s	28.72	5 33 49.9 ["]	0 20.4 ["]	2.34	.755 097	9 19 11
7	18 21 36.35 ^s	28.72	5 38 56.2 ["]	0 21.4 ["]	2.35	.748 720	9 16 33
8	18 22 54.33 ^s	28.72	5 44 08.4 ["]	0 22.4 ["]	2.35	.742 244	9 13 54
9	18 24 11.86 ^s	+0 28.72	+ 5 49 26.4 ["]	+0 23.4 ["]	2.36	3.735 669	9 11 16
10	18 25 28.93 ^s	28.73	5 54 50.2 ["]	0 24.3 ["]	2.36	.728 997	9 08 36
11	18 26 45.55 ^s	28.73	6 00 19.8 ["]	0 25.3 ["]	2.37	.722 227	9 05 56
12	18 28 01.70 ^s	28.72	6 05 55.0 ["]	0 26.2 ["]	2.37	.715 362	9 03 16
13	18 29 17.38 ^s	28.72	6 11 36.0 ["]	0 27.2 ["]	2.37	.708 401	9 00 35
14	18 30 32.58 ^s	+0 28.72	+ 6 17 22.6 ["]	+0 28.1 ["]	2.38	3.701 347	8 57 54
15	18 31 47.29 ^s	+0 28.71	+ 6 23 14.8 ["]	+0 29.0 ["]	2.38	3.694 199	8 55 12

Magnitude: Jan. 27, 9.9

* On the date so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
Feb. 15	^{h m s} 18 31 47.29 ^s	^{m s} +0 28.71	^{° ' "} + 6 23 14.8	^{' "} +0 29.0	2.38	3.694 199	^{h m s} 8 55 12
16*	18 33 01.52 ⁺ 74.23	28.70	6 29 12.5 ⁺ 357.7	0 30.0	2.39	.686 958	8 52 30
17	18 34 15.24 ^{73.72}	28.70	6 35 15.8 ^{363.3}	0 30.9	2.39	.679 625	8 49 47
18	18 35 28.46 ^{73.22}	28.69	6 41 24.6 ^{368.8}	0 31.9	2.40	.672 202	8 47 04
19	18 36 41.16 ^{72.70}	28.69	6 47 38.9 ^{374.3}	0 32.8	2.40	.664 687	8 44 20
	^{72.18}		^{379.7}				
20	18 37 53.34 ⁺ 71.65	+0 28.68	+ 6 53 58.6 ⁺ 385.1	+0 33.8	2.41	3.657 083	8 41 36
21	18 39 04.99 ⁺ 71.10	28.68	7 00 23.7 ⁺ 390.5	0 34.7	2.41	.649 390	8 38 51
22	18 40 16.09 ^{70.56}	28.68	7 06 54.2 ^{395.7}	0 35.7	2.42	.641 610	8 36 06
23	18 41 26.65 ^{69.99}	28.69	7 13 29.9 ^{401.0}	0 36.5	2.42	.633 742	8 33 20
24	18 42 36.64 ^{69.43}	28.69	7 20 10.9 ^{406.2}	0 37.4	2.43	.625 789	8 30 34
25	18 43 46.07 ⁺ 68.84	+0 28.68	+ 7 26 57.1 ⁺ 411.4	+0 38.3	2.43	3.617 752	8 27 47
26	18 44 54.91 ^{68.26}	28.68	7 33 48.5 ⁺ 416.4	0 39.1	2.44	.609 632	8 24 59
27	18 46 03.17 ^{67.66}	28.67	7 40 44.9 ^{421.4}	0 40.0	2.44	.601 430	8 22 11
28	18 47 10.83 ^{67.05}	28.66	7 47 46.3 ^{426.4}	0 40.8	2.45	.593 148	8 19 22
29*	18 48 17.88 ^{66.44}	28.65	7 54 52.7 ^{431.3}	0 41.6	2.46	.584 789	8 16 33
Mar. 1	18 49 24.32 ⁺ 65.81	+0 28.64	+ 8 02 04.0 ⁺ 436.0	+0 42.5	2.46	3.576 352	8 13 43
2	18 50 30.13 ^{65.19}	28.64	8 09 20.0 ⁺ 440.9	0 43.4	2.47	.567 840	8 10 52
3	18 51 35.32 ^{64.54}	28.63	8 16 40.9 ^{445.4}	0 44.2	2.47	.559 255	8 08 01
4	18 52 39.86 ^{63.90}	28.62	8 24 06.3 ^{450.1}	0 45.1	2.48	.550 598	8 05 09
5	18 53 43.76 ^{63.25}	28.62	8 31 36.4 ^{454.7}	0 45.9	2.49	.541 871	8 02 17
6	18 54 47.01 ⁺ 62.58	+0 28.62	+ 8 39 11.1 ⁺ 459.1	+0 46.7	2.49	3.533 075	7 59 23
7	18 55 49.59 ^{61.92}	28.61	8 46 50.2 ⁺ 463.5	0 47.6	2.50	.524 212	7 56 29
8	18 56 51.51 ^{61.23}	28.61	8 54 33.7 ^{467.9}	0 48.4	2.50	.515 284	7 53 35
9	18 57 52.74 ^{60.56}	28.60	9 02 21.6 ^{472.1}	0 49.1	2.51	.506 291	7 50 40
10	18 58 53.30 ^{59.86}	28.60	9 10 13.7 ^{476.3}	0 49.9	2.52	.497 235	7 47 44
11	18 59 53.16 ⁺ 59.16	+0 28.59	+ 9 18 10.0 ⁺ 480.4	+0 50.6	2.52	3.488 118	7 44 47
12	19 00 52.32 ⁺ 58.45	28.58	9 26 10.4 ⁺ 484.5	0 51.4	2.53	.478 942	7 41 50
13	19 01 50.77 ^{57.74}	28.57	9 34 14.9 ^{488.5}	0 52.1	2.54	.469 707	7 38 52
14	19 02 48.51 ^{57.02}	28.56	9 42 23.4 ^{492.3}	0 52.8	2.54	.460 414	7 35 53
15*	19 03 45.53 ^{56.28}	28.55	9 50 35.7 ^{496.3}	0 53.6	2.55	.451 066	7 32 54
16	19 04 41.81 ⁺ 55.54	+0 28.54	+ 9 58 52.0 ⁺ 500.0	+0 54.3	2.56	3.441 663	7 29 54
17	19 05 37.35 ^{54.78}	28.53	10 07 12.0 ⁺ 503.8	0 55.1	2.56	.432 206	7 26 53
18	19 06 32.13 ^{54.03}	28.52	10 15 35.8 ^{507.3}	0 55.8	2.57	.422 698	7 23 51
19	19 07 26.16 ^{53.26}	28.52	10 24 03.1 ^{511.0}	0 56.5	2.58	.413 138	7 20 49
20	19 08 19.42 ^{52.47}	28.52	10 32 34.1 ^{514.4}	0 57.3	2.59	.403 529	7 17 46
21	19 09 11.89 ⁺ 51.67	+0 28.52	+ 10 41 08.5 ⁺ 517.8	+0 57.9	2.59	3.393 873	7 14 42
22	19 10 03.56 ^{50.88}	28.52	10 49 46.3 ⁺ 521.0	0 58.6	2.60	.384 170	7 11 37
23	19 10 54.44 ^{50.05}	28.51	10 58 27.3 ^{524.3}	0 59.3	2.61	.374 423	7 08 32
24	19 11 44.49 ^{49.23}	28.50	11 07 11.6 ^{527.4}	0 59.9	2.62	.364 633	7 05 25
25	19 12 33.72 ^{48.39}	28.49	11 15 59.0 ^{530.3}	1 00.5	2.62	.354 803	7 02 18
26	19 13 22.11 ⁺ 47.54	+0 28.48	+ 11 24 49.3 ⁺ 533.2	+1 01.1	2.63	3.344 934	6 59 10
27	19 14 09.65 ^{46.68}	28.47	11 33 42.5 ⁺ 535.9	1 01.7	2.64	.335 028	6 56 01
28*	19 14 56.33 ^{45.82}	28.46	11 42 38.4 ^{538.6}	1 02.3	2.65	.325 088	6 52 52
29	19 15 42.15 ^{44.93}	28.45	11 51 37.0 ^{541.2}	1 03.0	2.66	.315 116	6 49 41
30	19 16 27.08 ^{44.05}	28.44	12 00 38.2 ^{543.5}	1 03.6	2.66	.305 114	6 46 30
31	19 17 11.13 ⁺ 43.14	+0 28.43	+ 12 09 41.7 ⁺ 545.7	+1 04.2	2.67	3.295 084	6 43 17
Apr. 1	19 17 54.27	+0 28.43	+ 12 18 47.4	+1 04.8	2.68	3.285 029	6 40 04

Magnitude: Feb. 16, 9.9; Mar. 7, 9.8; Mar. 27, 9.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	[°] ['] ["]			^h ^m ^s
Apr. 1	19 17 54.27 ^s	+0 28.43	+12 18 47.4	+1 04.8	2.68	3.285 029	6 40 04
2	19 18 36.52 ⁺ 42.25	28.42	12 27 55.4 ⁺ 548.0	1 05.4	2.69	.274 950	6 36 50
3	19 19 17.84 ⁺ 41.32	28.42	12 37 05.4 ⁺ 550.0	1 06.0	2.70	.264 850	6 33 35
4	19 19 58.24 ⁺ 40.40	28.41	12 46 17.3 ⁺ 551.9	1 06.6	2.70	.254 731	6 30 19
5	19 20 37.71 ⁺ 39.47	28.41	12 55 30.9 ⁺ 553.6	1 07.1	2.71	.244 595	6 27 02
6	19 21 16.24 ⁺ 38.53	+0 28.40	13 04 46.3 ⁺ 555.4	+1 07.6	2.72	3.234 443	6 23 44
7	19 21 53.82 ⁺ 37.58	28.39	13 14 03.1 ⁺ 556.8	1 08.1	2.73	.224 279	6 20 25
8	19 22 30.43 ⁺ 36.61	28.38	13 23 21.4 ⁺ 558.3	1 08.6	2.74	.214 104	6 17 06
9	19 23 06.08 ⁺ 35.65	28.37	13 32 41.0 ⁺ 559.6	1 09.1	2.75	.203 920	6 13 45
10	19 23 40.76 ⁺ 34.68	28.36	13 42 01.7 ⁺ 560.7	1 09.6	2.76	.193 728	6 10 23
	33.68		561.7				
11*	19 24 14.44 ⁺ 33.68	+0 28.35	+13 51 23.4 ⁺ 561.7	+1 10.0	2.77	3.183 532	6 07 01
12	19 24 47.14 ⁺ 32.70	28.34	14 00 46.0 ⁺ 562.6	1 10.5	2.77	.173 333	6 03 37
13	19 25 18.82 ⁺ 31.68	28.33	14 10 09.3 ⁺ 563.3	1 11.0	2.78	.163 133	6 00 12
14	19 25 49.50 ⁺ 30.68	28.32	14 19 33.3 ⁺ 564.0	1 11.5	2.79	.152 933	5 56 47
15	19 26 19.15 ⁺ 29.65	28.32	14 28 57.7 ⁺ 564.4	1 12.0	2.80	.142 735	5 53 20
	28.61		564.8				
16	19 26 47.76 ⁺ 27.57	+0 28.32	+14 38 22.5 ⁺ 565.0	+1 12.4	2.81	3.132 543	5 49 52
17	19 27 15.33 ⁺ 26.50	28.31	14 47 47.5 ⁺ 565.0	1 12.9	2.82	.122 356	5 46 24
18	19 27 41.83 ⁺ 25.44	28.31	14 57 12.5 ⁺ 565.0	1 13.3	2.83	.112 179	5 42 54
19	19 28 07.27 ⁺ 24.36	28.31	15 06 37.3 ⁺ 564.8	1 13.6	2.84	.102 012	5 39 23
20	19 28 31.63 ⁺ 23.26	28.30	15 16 01.8 ⁺ 564.5	1 14.0	2.85	.091 859	5 35 51
			564.1				
21	19 28 54.89 ⁺ 22.16	+0 28.29	+15 25 25.9 ⁺ 564.1	+1 14.3	2.86	3.081 722	5 32 18
22	19 29 17.05 ⁺ 21.05	28.28	15 34 49.2 ⁺ 563.3	1 14.7	2.87	.071 604	5 28 44
23	19 29 38.10 ⁺ 19.92	28.27	15 44 11.6 ⁺ 562.4	1 15.0	2.88	.061 506	5 25 09
24*	19 29 58.02 ⁺ 18.80	28.26	15 53 33.0 ⁺ 561.4	1 15.3	2.88	.051 433	5 21 32
25	19 30 16.82 ⁺ 17.65	28.25	16 02 53.1 ⁺ 560.1	1 15.7	2.89	.041 387	5 17 55
			558.6				
26	19 30 34.47 ⁺ 16.50	+0 28.24	+16 12 11.7 ⁺ 558.6	+1 16.0	2.90	3.031 370	5 14 16
27	19 30 50.97 ⁺ 15.35	28.24	16 21 28.6 ⁺ 556.9	1 16.3	2.91	.021 386	5 10 36
28	19 31 06.32 ⁺ 14.18	28.23	16 30 43.5 ⁺ 554.9	1 16.7	2.92	.011 437	5 06 56
29	19 31 20.50 ⁺ 13.01	28.23	16 39 56.4 ⁺ 552.9	1 17.0	2.93	3.001 526	5 03 13
30	19 31 33.51 ⁺ 11.83	28.22	16 49 06.9 ⁺ 550.5	1 17.2	2.94	2.991 656	4 59 30
			548.0				
May 1	19 31 45.34 ⁺ 10.66	+0 28.22	+16 58 14.9 ⁺ 548.0	+1 17.5	2.95	2.981 829	4 55 46
2	19 31 56.00 ⁺ 9.46	28.22	17 07 20.1 ⁺ 545.2	1 17.8	2.96	.972 049	4 52 00
3	19 32 05.46 ⁺ 8.27	28.21	17 16 22.2 ⁺ 542.1	1 18.0	2.97	.962 318	4 48 14
4	19 32 13.73 ⁺ 7.07	28.21	17 25 21.2 ⁺ 539.0	1 18.2	2.98	.952 638	4 44 26
5	19 32 20.80 ⁺ 5.87	28.20	17 34 16.6 ⁺ 535.4	1 18.4	2.99	.943 013	4 40 37
			531.8				
6	19 32 26.67 ⁺ 4.67	+0 28.19	+17 43 08.4 ⁺ 531.8	+1 18.6	3.00	2.933 445	4 36 46
7	19 32 31.34 ⁺ 3.45	28.18	17 51 56.3 ⁺ 527.9	1 18.7	3.01	.923 936	4 32 55
8	19 32 34.79 ⁺ 2.24	28.17	18 00 40.0 ⁺ 523.7	1 18.9	3.02	.914 490	4 29 02
9*	19 32 37.03 ⁺ 1.03	28.16	18 09 19.4 ⁺ 519.4	1 19.0	3.03	.905 108	4 25 08
10	19 32 38.06 ⁺ 0.20	28.15	18 17 54.1 ⁺ 514.7	1 19.2	3.04	.895 794	4 21 13
			509.9				
11	19 32 37.86 ⁺ 1.42	+0 28.15	+18 26 24.0 ⁺ 509.9	+1 19.4	3.05	2.886 549	4 17 17
12	19 32 36.44 ⁺ 2.65	28.15	18 34 48.9 ⁺ 504.9	1 19.5	3.06	.877 376	4 13 19
13	19 32 33.79 ⁺ 3.87	28.14	18 43 08.4 ⁺ 499.5	1 19.7	3.07	.868 278	4 09 20
14	19 32 29.92 ⁺ 5.12	28.15	18 51 22.3 ⁺ 493.9	1 19.8	3.08	.859 257	4 05 20
15	19 32 24.80 ⁺ 6.35	28.14	18 59 30.4 ⁺ 488.1	1 19.9	3.09	.850 315	4 01 19
			482.1				
16	19 32 18.45 ⁺ 7.59	+0 28.14	+19 07 32.5 ⁺ 482.1	+1 20.0	3.10	2.841 456	3 57 17
17	19 32 10.86 ⁺	+0 28.14	+19 15 28.1 ⁺ 475.6	+1 20.0	3.11	2.832 682	3 53 13

Magnitude : Apr. 16, 9.6 ; May 6, 9.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	h m s	m s	° ' "	' "			h m s
May 17	19 32 10.86	8.83	+0 28.14	+19 15 28.1	3.11	2.832 682	3 53 13
18	19 32 02.03	10.07	28.13	19 23 17.1	3.12	.823 997	3 49 08
19	19 31 51.96	11.32	28.13	19 30 59.1	3.13	.815 403	3 45 02
20	19 31 40.64	12.56	28.12	19 38 33.9	3.14	.806 904	3 40 55
21	19 31 28.08	13.80	28.11	19 46 01.1	3.15	.798 502	3 36 46
22*	19 31 14.28	15.03	+0 28.10	+19 53 20.5	3.15	2.790 202	3 32 36
23	19 30 59.25	16.25	28.10	20 00 31.8	3.16	.782 005	3 28 25
24	19 30 43.00	17.48	28.09	20 07 34.6	3.17	.773 916	3 24 13
25	19 30 25.52	18.70	28.09	20 14 28.6	3.18	.765 937	3 20 00
26	19 30 06.82	19.89	28.09	20 21 13.6	3.19	.758 072	3 15 45
27	19 29 46.93	21.10	+0 28.09	+20 27 49.2	3.20	2.750 324	3 11 29
28	19 29 25.83	22.28	28.09	20 34 15.1	3.21	.742 695	3 07 12
29	19 29 03.55	23.45	28.09	20 40 31.1	3.22	.735 190	3 02 54
30	19 28 40.10	24.61	28.09	20 46 36.9	3.23	.727 810	2 58 34
31	19 28 15.49	25.75	28.08	20 52 32.0	3.24	.720 559	2 54 14
June 1	19 27 49.74	26.88	+0 28.08	+20 58 16.4	3.24	2.713 439	2 49 52
2	19 27 22.86	28.00	28.08	21 03 49.5	3.25	.706 453	2 45 29
3	19 26 54.86	29.09	28.07	21 09 11.3	3.26	.699 605	2 41 06
4	19 26 25.77	30.17	28.07	21 14 21.5	3.27	.692 897	2 36 41
5*	19 25 55.60	31.23	28.06	21 19 19.6	3.28	.686 330	2 32 15
6	19 25 24.37	32.26	+0 28.06	+21 24 05.6	3.28	2.679 909	2 27 48
7	19 24 52.11	33.29	28.06	21 28 39.0	3.29	.673 635	2 23 19
8	19 24 18.82	34.28	28.06	21 32 59.8	3.30	.667 511	2 18 50
9	19 23 44.54	35.26	28.06	21 37 07.5	3.31	.661 538	2 14 20
10	19 23 09.28	36.22	28.07	21 41 02.1	3.31	.655 720	2 09 49
11	19 22 33.06	37.15	+0 28.08	+21 44 43.2	3.32	2.650 059	2 05 17
12	19 21 55.91	38.07	28.08	21 48 10.6	3.33	.644 557	2 00 44
13	19 21 17.84	38.95	28.09	21 51 24.0	3.34	.639 217	1 56 10
14	19 20 38.89	39.81	28.09	21 54 23.2	3.34	.634 042	1 51 36
15	19 19 59.08	40.65	28.09	21 57 08.0	3.35	.629 034	1 47 00
16	19 19 18.43	41.45	+0 28.09	+21 59 38.0	3.35	2.624 195	1 42 24
17	19 18 36.98	42.22	28.09	22 01 53.2	3.36	.619 530	1 37 47
18*	19 17 54.76	42.97	28.09	22 03 53.1	3.37	.615 039	1 33 09
19	19 17 11.79	43.68	28.09	22 05 37.7	3.37	.610 727	1 28 30
20	19 16 28.11	44.34	28.10	22 07 06.7	3.38	.606 595	1 23 51
21	19 15 43.77	44.99	+0 28.10	+22 08 20.0	3.38	2.602 646	1 19 11
22	19 14 58.78	45.59	28.11	22 09 17.3	3.39	.598 883	1 14 30
23	19 14 13.19	46.15	28.12	22 09 58.5	3.39	.595 307	1 09 49
24	19 13 27.04	46.67	28.13	22 10 23.4	3.40	.591 921	1 05 07
25	19 12 40.37	47.15	28.14	22 10 31.9	3.40	.588 727	1 00 25
26	19 11 53.22	47.59	+0 28.15	+22 10 23.9	3.40	2.585 727	0 55 42
27	19 11 05.63	47.99	28.16	22 09 59.3	3.41	.582 923	0 50 59
28	19 10 17.64	48.36	28.17	22 09 18.1	3.41	.580 316	0 46 15
29	19 09 29.28	48.66	28.18	22 08 20.0	3.41	.577 909	0 41 31
30	19 08 40.62	48.94	28.19	22 07 05.2	3.42	.575 702	0 36 47
July 1	19 07 51.68	49.16	+0 28.19	+22 05 33.5	3.42	2.573 697	0 32 02
2*	19 07 02.52		+0 28.20	+22 03 44.9	3.42	2.571 896	0 27 18

Magnitude : May 26, 9.3 ; June 15, 9.2

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
July	^{h m s} 19 07 51.68	^{m s} +0 28.19	^{° ' "} +22 05 33.5	^{' "} +1 10.4	3.42	2.573 697	^{h m s} 0 32 02
	2* 19 07 02.52	28.20	22 03 44.9	1 10.0	3.42	.571 896	0 27 18
	3 19 06 13.17	28.21	22 01 39.5	1 09.6	3.42	.570 299	0 22 33
	4 19 05 23.68	28.22	21 59 17.2	1 09.2	3.43	.568 908	0 17 47
	5 19 04 34.08	28.24	21 56 38.1	1 08.8	3.43	.567 723	0 13 02
	6 19 03 44.43	+0 28.26	+21 53 42.3	+1 08.4	3.43	2.566 746	0 08 17
	7 19 02 54.77	28.27	21 50 29.8	1 08.0	3.43	.565 976	{ 0 03 32 }
	8 19 02 05.13	28.30	21 47 00.7	1 07.5	3.43	.565 416	{ 23 58 47 }
	9 19 01 15.55	28.32	21 43 15.0	1 07.1	3.43	.565 064	23 54 01
	10 19 00 26.08	28.34	21 39 12.9	1 06.6	3.43	.564 923	23 49 16
							23 44 31
	11 18 59 36.75	+0 28.36	+21 34 54.4	+1 06.1	3.43	2.564 994	23 39 47
	12 18 58 47.61	28.38	21 30 19.7	1 05.6	3.43	.565 276	23 35 02
	13 18 57 58.69	28.40	21 25 28.8	1 05.1	3.43	.565 771	23 30 18
	14* 18 57 10.04	28.41	21 20 22.0	1 04.7	3.43	.566 479	23 25 34
	15 18 56 21.70	28.43	21 14 59.2	1 04.2	3.43	.567 401	23 20 50
	16 18 55 33.71	+0 28.45	+21 09 20.8	+1 03.8	3.43	2.568 538	23 16 07
	17 18 54 46.11	28.47	21 03 26.9	1 03.4	3.43	.569 890	23 11 24
	18 18 53 58.94	28.49	20 57 17.6	1 02.9	3.42	.571 458	23 06 42
	19 18 53 12.24	28.52	20 50 53.2	1 02.5	3.42	.573 241	23 02 00
	20 18 52 26.05	28.54	20 44 13.9	1 02.1	3.42	.575 240	22 57 19
	21 18 51 40.42	+0 28.57	+20 37 20.0	+1 01.7	3.42	2.577 455	22 52 38
	22 18 50 55.37	28.60	20 30 11.6	1 01.3	3.41	.579 885	22 47 58
	23 18 50 10.96	28.63	20 22 49.1	1 00.8	3.41	.582 530	22 43 19
	24 18 49 27.21	28.66	20 15 12.7	1 00.4	3.40	.585 390	22 38 40
	25 18 48 44.16	28.68	20 07 22.8	0 59.9	3.40	.588 464	22 34 02
	26 18 48 01.85	+0 28.71	+19 59 19.6	+0 59.5	3.40	2.591 751	22 29 25
	27 18 47 20.32	28.74	19 51 03.5	0 59.0	3.39	.595 251	22 24 48
	28 18 46 39.59	28.76	19 42 34.7	0 58.6	3.39	.598 962	22 20 13
	29* 18 45 59.69	28.79	19 33 53.7	0 58.2	3.38	.602 883	22 15 38
	30 18 45 20.66	28.81	19 25 00.8	0 57.8	3.38	.607 012	22 11 04
Aug.	31 18 44 42.53	+0 28.84	+19 15 56.3	+0 57.5	3.37	2.611 350	22 06 31
	1 18 44 05.31	28.87	19 06 40.6	0 57.1	3.37	.615 893	22 01 59
	2 18 43 29.05	28.90	18 57 14.2	0 56.8	3.36	.620 640	21 57 28
	3 18 42 53.75	28.94	18 47 37.2	0 56.5	3.35	.625 590	21 52 58
	4 18 42 19.44	28.97	18 37 50.1	0 56.2	3.35	.630 740	21 48 29
	5 18 41 46.15	+0 29.01	+18 27 53.4	+0 55.8	3.34	2.636 090	21 44 01
	6 18 41 13.89	29.05	18 17 47.2	0 55.5	3.33	.641 638	21 39 34
	7 18 40 42.67	29.09	18 07 32.1	0 55.1	3.33	.647 382	21 35 08
	8 18 40 12.52	29.12	17 57 08.4	0 54.8	3.32	.653 320	21 30 43
	9 18 39 43.46	29.15	17 46 36.4	0 54.5	3.31	.659 450	21 26 19
	10* 18 39 15.49	+0 29.18	+17 35 56.5	+0 54.2	3.30	2.665 772	21 21 57
	11 18 38 48.63	29.21	17 25 09.1	0 53.9	3.29	.672 284	21 17 35
	12 18 38 22.91	29.24	17 14 14.4	0 53.6	3.29	.678 983	21 13 15
	13 18 37 58.32	29.27	17 03 12.9	0 53.4	3.28	.685 869	21 08 55
	14 18 37 34.89	29.31	16 52 04.9	0 53.2	3.27	.692 939	21 04 37
	15 18 37 12.63	+0 29.34	+16 40 50.8	+0 53.0	3.26	2.700 191	21 00 20
	16 18 36 51.55	+0 29.38	+16 29 30.9	+0 52.8	3.25	2.707 624	20 56 04

Magnitude: July 5, 9.2; July 25, 9.2; Aug. 14, 9.3

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
Aug. 16	^h 18 ^m 36 ^s 51.55 - ^s 19.89	^m +0 29.38	[°] +16 29 30.9 - ["] 685.3	['] +0 52.8	3.25	2.707 624	^h 20 ^m 56 ^s 04
17	18 36 31.66 - 18.69	29.42	16 18 05.6 - 690.3	0 52.6	3.24	.715 234	20 51 50
18	18 36 12.97 - 17.48	29.46	16 06 35.3 - 695.0	0 52.5	3.23	.723 021	20 47 36
19	18 35 55.49 - 16.26	29.50	15 55 00.3 - 699.3	0 52.3	3.22	.730 980	20 43 24
20	18 35 39.23 - 15.03	29.53	15 43 21.0 - 703.3	0 52.1	3.21	.739 111	20 39 13
21	18 35 24.20 - 13.81	+0 29.57	+15 31 37.7 - 706.8	+0 51.9	3.20	2.747 410	20 35 04
22	18 35 10.39 - 12.56	29.60	15 19 50.9 - 710.2	0 51.8	3.19	.755 874	20 30 55
23	18 34 57.83 - 11.32	29.64	15 08 00.7 - 712.9	0 51.6	3.18	.764 502	20 26 48
24	18 34 46.51 - 10.08	29.67	14 56 07.8 - 715.6	0 51.5	3.17	.773 289	20 22 42
25*	18 34 36.43 - 8.83	29.70	14 44 12.2 - 717.7	0 51.4	3.16	.782 234	20 18 37
26	18 34 27.60 - 7.59	+0 29.73	+14 32 14.5 - 719.6	+0 51.3	3.15	2.791 332	20 14 33
27	18 34 20.01 - 6.34	29.76	14 20 14.9 - 721.1	0 51.3	3.14	.800 582	20 10 31
28	18 34 13.67 - 5.09	29.80	14 08 13.8 - 722.4	0 51.3	3.13	.809 979	20 06 30
29	18 34 08.58 - 3.85	29.83	13 56 11.4 - 723.2	0 51.3	3.12	.819 522	20 02 30
30	18 34 04.73 - 2.62	29.87	13 44 08.2 - 723.7	0 51.3	3.11	.829 206	19 58 31
31	18 34 02.11 - 1.38	+0 29.91	+13 32 04.5 - 724.1	+0 51.3	3.10	2.839 028	19 54 34
Sept. 1	18 34 00.73 - 0.16	29.95	13 20 00.4 - 724.0	0 51.3	3.09	.848 986	19 50 37
2	18 34 00.57 + 1.07	29.99	13 07 56.4 - 723.8	0 51.3	3.08	.859 076	19 46 42
3	18 34 01.64 + 2.28	30.03	12 55 52.6 - 723.1	0 51.3	3.07	.869 296	19 42 49
4	18 34 03.92 + 3.50	30.07	12 43 49.5 - 722.4	0 51.3	3.06	.879 643	19 38 56
5	18 34 07.42 + 4.68	+0 30.10	+12 31 47.1 - 721.3	+0 51.4	3.05	2.890 114	19 35 04
6	18 34 12.10 + 5.89	30.13	12 19 45.8 - 720.0	0 51.4	3.03	.900 706	19 31 14
7*	18 34 17.99 + 7.08	30.16	12 07 45.8 - 718.5	0 51.5	3.02	.911 416	19 27 25
8	18 34 25.07 + 8.25	30.19	11 55 47.3 - 716.7	0 51.6	3.01	.922 242	19 23 37
9	18 34 33.32 + 9.43	30.22	11 43 50.6 - 714.7	0 51.8	3.00	.933 182	19 19 51
10	18 34 42.75 + 10.60	+0 30.26	+11 31 55.9 - 712.5	+0 51.9	2.99	2.944 232	19 16 05
11	18 34 53.35 + 11.76	30.29	11 20 03.4 - 710.1	0 52.1	2.98	.955 390	19 12 21
12	18 35 05.11 + 12.92	30.32	11 08 13.3 - 707.5	0 52.3	2.97	.966 653	19 08 37
13	18 35 18.03 + 14.06	30.36	10 56 25.8 - 704.6	0 52.5	2.96	.978 018	19 04 55
14	18 35 32.09 + 15.20	30.40	10 44 41.2 - 701.6	0 52.7	2.94	2.989 482	19 01 14
15	18 35 47.29 + 16.34	+0 30.43	+10 32 59.6 - 698.3	+0 53.0	2.93	3.001 041	18 57 34
16	18 36 03.63 + 17.46	30.47	10 21 21.3 - 694.9	0 53.2	2.92	.012 694	18 53 56
17	18 36 21.09 + 18.58	30.50	10 09 46.4 - 691.3	0 53.4	2.91	.024 437	18 50 18
18	18 36 39.67 + 19.68	30.53	9 58 15.1 - 687.4	0 53.6	2.90	.036 266	18 46 42
19	18 36 59.35 + 20.78	30.56	9 46 47.7 - 683.5	0 53.8	2.89	.048 178	18 43 06
20	18 37 20.13 + 21.87	+0 30.59	+ 9 35 24.2 - 679.3	+0 54.1	2.88	3.060 171	18 39 32
21*	18 37 42.00 + 22.95	30.62	9 24 04.9 - 674.9	0 54.4	2.87	.072 240	18 35 58
22	18 38 04.95 + 24.02	30.64	9 12 50.0 - 670.5	0 54.7	2.85	.084 383	18 32 26
23	18 38 28.97 + 25.07	30.67	9 01 39.5 - 665.8	0 55.0	2.84	.096 596	18 28 55
24	18 38 54.04 + 26.12	30.70	8 50 33.7 - 660.9	0 55.4	2.83	.108 876	18 25 25
25	18 39 20.16 + 27.16	+0 30.73	+ 8 39 32.8 - 656.0	+0 55.8	2.82	3.121 219	18 21 56
26	18 39 47.32 + 28.17	30.76	8 28 36.8 - 650.9	0 56.2	2.81	.133 622	18 18 28
27	18 40 15.49 + 29.18	30.79	8 17 45.9 - 645.7	0 56.6	2.80	.146 082	18 15 01
28	18 40 44.67 + 30.18	30.83	8 07 00.2 - 640.3	0 57.0	2.79	.158 595	18 11 35
29	18 41 14.85 + 31.16	30.86	7 56 19.9 - 634.8	0 57.4	2.78	.171 159	18 08 09
30	18 41 46.01 + 32.13	+0 30.89	+ 7 45 45.1 - 629.2	+0 57.8	2.77	3.183 770	18 04 45
Oct. 1	18 42 18.14 + 33.13	+0 30.92	+ 7 35 15.9 - 624.7	+0 58.1	2.75	3.196 426	18 01 22

Magnitude : Sept. 3, 9.4 ; Sept. 23, 9.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Oct. 1	^{h m s} 18 42 18.14 + ^s 33.08	^{m s} +0 30.92	^{° ' "} + 7 35 15.9 - ["] 623.6	^{° ' "} + 0 58.1	["] 2.75	3.196 426	^{h m s} 18 01 22
2	18 42 51.22 + 34.02	30.95	7 24 52.3 617.8	0 58.5	2.74	2.209 123	17 58 00
3	18 43 25.24 34.96	30.97	7 14 34.5 611.9	0 59.0	2.73	2.221 859	17 54 38
4*	18 44 00.20 35.87	31.00	7 04 22.6 606.0	0 59.4	2.72	2.234 632	17 51 18
5	18 44 36.07 36.79	31.02	6 54 16.6 600.0	0 59.9	2.71	2.247 438	17 47 59
6	18 45 12.86 + 37.68	+0 31.04	+ 6 44 16.6 - 593.9	+ 1 00.4	2.70	3.260 275	17 44 40
7	18 45 50.54 38.56	31.07	6 34 22.7 587.7	1 00.9	2.69	2.273 141	17 41 22
8	18 46 29.10 39.43	31.09	6 24 35.0 581.4	1 01.5	2.68	2.286 033	17 38 05
9	18 47 08.53 40.30	31.12	6 14 53.6 575.2	1 02.0	2.67	2.298 949	17 34 49
10	18 47 48.83 41.16	31.15	6 05 18.4 568.7	1 02.6	2.66	2.311 885	17 31 34
11	18 48 29.99 + 42.00	+0 31.18	+ 5 55 49.7 - 562.4	+ 1 03.1	2.65	3.324 839	17 28 20
12	18 49 11.99 42.83	31.20	5 46 27.3 555.8	1 03.7	2.64	2.337 808	17 25 06
13	18 49 54.82 43.65	31.23	5 37 11.5 549.2	1 04.2	2.63	2.350 790	17 21 54
14	18 50 38.47 44.47	31.26	5 28 02.3 542.6	1 04.8	2.62	2.363 781	17 18 42
15	18 51 22.94 45.27	31.28	5 18 59.7 535.9	1 05.3	2.61	2.376 779	17 15 31
16	18 52 08.21 + 46.06	+0 31.30	+ 5 10 03.8 - 529.2	+ 1 05.9	2.60	3.389 781	17 12 20
17	18 52 54.27 46.84	31.32	5 01 14.6 522.3	1 06.5	2.59	2.402 784	17 09 11
18	18 53 41.11 47.61	31.34	4 52 32.3 515.6	1 07.1	2.58	2.415 785	17 06 02
19*	18 54 28.72 48.37	31.36	4 43 56.7 508.6	1 07.7	2.57	2.428 781	17 02 54
20	18 55 17.09 49.12	31.38	4 35 28.1 501.6	1 08.4	2.56	2.441 769	16 59 47
21	18 56 06.21 + 49.85	+0 31.39	+ 4 27 06.5 - 494.7	+ 1 09.0	2.55	3.454 746	16 56 41
22	18 56 56.06 50.58	31.42	4 18 51.8 487.6	1 09.7	2.54	2.467 709	16 53 35
23	18 57 46.64 51.29	31.44	4 10 44.2 480.5	1 10.4	2.53	2.480 655	16 50 30
24	18 58 37.93 52.00	31.46	4 02 43.7 473.5	1 11.1	2.52	2.493 581	16 47 25
25	18 59 29.93 52.68	31.49	3 54 50.2 466.3	1 11.8	2.51	2.506 484	16 44 22
26	19 00 22.61 + 53.35	+0 31.52	+ 3 47 03.9 - 459.2	+ 1 12.5	2.50	3.519 362	16 41 19
27	19 01 15.96 54.02	31.54	3 39 24.7 452.0	1 13.2	2.49	2.532 212	16 38 16
28	19 02 09.98 54.67	31.56	3 31 52.7 444.8	1 13.9	2.48	2.545 031	16 35 15
29	19 03 04.65 55.31	31.58	3 24 27.9 437.6	1 14.5	2.47	2.557 816	16 32 14
30	19 03 59.96 55.94	31.60	3 17 10.3 430.4	1 15.2	2.47	2.570 567	16 29 13
31	19 04 55.90 + 56.55	+0 31.61	+ 3 09 59.9 - 423.2	+ 1 15.9	2.46	3.583 279	16 26 13
Nov. 1*	19 05 52.45 57.17	31.63	3 02 56.7 416.1	1 16.7	2.45	2.595 952	16 23 14
2	19 06 49.62 57.75	31.64	2 56 00.6 408.8	1 17.4	2.44	2.608 584	16 20 16
3	19 07 47.37 58.34	31.66	2 49 11.8 401.6	1 18.2	2.43	2.621 171	16 17 18
4	19 08 45.71 58.92	31.68	2 42 30.2 394.3	1 19.0	2.42	2.633 712	16 14 20
5	19 09 44.63 + 59.49	+0 31.69	+ 2 35 55.9 - 387.2	+ 1 19.8	2.41	3.646 205	16 11 23
6	19 10 44.12 60.04	31.71	2 29 28.7 380.0	1 20.6	2.41	2.658 648	16 08 27
7	19 11 44.16 60.60	31.73	2 23 08.7 372.8	1 21.3	2.40	2.671 039	16 05 31
8	19 12 44.76 61.13	31.76	2 16 55.9 365.5	1 22.2	2.39	2.683 374	16 02 36
9	19 13 45.89 61.67	31.78	2 10 50.4 358.4	1 22.9	2.38	2.695 653	15 59 41
10	19 14 47.56 + 62.19	+0 31.79	+ 2 04 52.0 - 351.2	+ 1 23.7	2.37	3.707 873	15 56 47
11	19 15 49.75 62.70	31.81	1 59 00.8 343.9	1 24.5	2.37	2.720 031	15 53 54
12	19 16 52.45 63.21	31.82	1 53 16.9 336.8	1 25.3	2.36	2.732 126	15 51 00
13	19 17 55.66 63.71	31.84	1 47 40.1 329.5	1 26.1	2.35	2.744 155	15 48 08
14	19 18 59.37 64.20	31.85	1 42 10.6 322.4	1 26.9	2.34	2.756 114	15 45 16
15	19 20 03.57 + 64.67	+0 31.86	+ 1 36 48.2 - 315.2	+ 1 27.7	2.34	3.768 004	15 42 24
16*	19 21 08.24 65.16	+0 31.87	+ 1 31 33.0	+ 1 28.5	2.33	3.779 819	15 39 33

Magnitude: Oct. 13, 9.8; Nov. 2, 10.0

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Nov. 16*	19 21 08.24 + 65.15	+0 31.87	+ 1 31 33.0 - 307.9	+ 1 28.5	2.33	3.779 819	15 39 33
17	19 22 13.39 65.61	31.88	1 26 25.1 - 300.9	1 29.3	2.32	.791 560	15 36 42
18	19 23 19.00 66.06	31.89	1 21 24.2 - 293.6	1 30.2	2.31	.803 221	15 33 52
19	19 24 25.06 66.50	31.91	1 16 30.6 - 286.5	1 31.1	2.31	.814 802	15 31 02
20	19 25 31.56 66.94	31.92	1 11 44.1 - 279.3	1 31.9	2.30	.826 300	15 28 12
21	19 26 38.50 + 67.36	+0 31.94	+ 1 07 04.8 - 272.2	+ 1 32.8	2.29	3.837 713	15 25 23
22	19 27 45.86 67.77	31.96	1 02 32.6 - 265.1	1 33.7	2.29	.849 038	15 22 35
23	19 28 53.63 68.17	31.98	0 58 07.5 - 258.0	1 34.5	2.28	.860 272	15 19 47
24	19 30 01.80 68.56	32.00	0 53 49.5 - 250.9	1 35.4	2.27	.871 415	15 16 59
25	19 31 10.36 68.95	32.01	0 49 38.6 - 243.9	1 36.2	2.27	.882 463	15 14 11
26	19 32 19.31 + 69.32	+0 32.02	+ 0 45 34.7 - 236.9	+ 1 37.0	2.26	3.893 416	15 11 24
27	19 33 28.63 69.68	32.03	0 41 37.8 - 229.9	1 37.9	2.25	.904 272	15 08 38
28	19 34 38.31 70.03	32.04	0 37 47.9 - 222.9	1 38.7	2.25	.915 029	15 05 51
29*	19 35 48.34 70.39	32.04	0 34 05.0 - 216.1	1 39.6	2.24	.925 685	15 03 05
30	19 36 58.73 70.72	32.05	0 30 28.9 - 209.1	1 40.5	2.24	.936 239	15 00 20
Dec. 1	19 38 09.45 + 71.05	+0 32.06	+ 0 26 59.8 - 202.3	+ 1 41.4	2.23	3.946 690	14 57 34
2	19 39 20.50 71.37	32.07	0 23 37.5 - 195.5	1 42.3	2.22	.957 035	14 54 49
3	19 40 31.87 71.69	32.09	0 20 22.0 - 188.6	1 43.2	2.22	.967 274	14 52 05
4	19 41 43.56 72.00	32.10	0 17 13.4 - 182.0	1 44.1	2.21	.977 405	14 49 20
5	19 42 55.56 72.30	32.11	0 14 11.4 - 175.1	1 45.0	2.21	.987 426	14 46 36
6	19 44 07.86 + 72.59	+0 32.13	+ 0 11 16.3 - 168.5	+ 1 45.9	2.20	3.997 335	14 43 53
7	19 45 20.45 72.89	32.14	0 08 27.8 - 161.8	1 46.8	2.20	4.007 131	14 41 09
8	19 46 33.34 73.16	32.15	0 05 46.0 - 155.2	1 47.7	2.19	.016 813	14 38 26
9	19 47 46.50 + 73.44	32.16	0 03 10.8 - 148.6	1 48.5	2.19	.026 379	14 35 43
10	19 48 59.94	+0 32.17	+ 0 00 42.2	+ 1 49.4	2.18	4.035 827	14 33 00

Magnitude : Nov. 22, 10.1 ; Dec. 12, 10.2

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1960

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit	
	Astrometric 1950.0	App. -Astr	Astrometric 1950.0	App. -Astr				
	<small>h m s</small>	<small>m s</small>	<small>° ' "</small>	<small>' "</small>			<small>h m s</small>	
Jan. 10	16 34 20.29 ⁺	74.71	+0 32.42	-11 55 20.7	-1 04.0	2.18	4.038 259	9 19 42
11	16 35 35.00	74.42	32.45	11 56 00.2	1 03.1	2.19	.028 601	9 17 01
12	16 36 49.42	74.13	32.49	11 56 35.2	1 02.2	2.19	.018 804	9 14 19
13	16 38 03.55	73.83	32.52	11 57 05.7	1 01.2	2.20	4.008 868	9 11 37
14	16 39 17.38	73.53	32.55	11 57 31.8	1 00.4	2.20	3.998 796	9 08 54
15	16 40 30.91	73.22	+0 32.58	-11 57 53.4	-0 59.5	2.21	3.988 588	9 06 11
16	16 41 44.13	72.90	32.61	11 58 10.5	0 58.6	2.21	.978 245	9 03 28
17*	16 42 57.03	72.57	32.63	11 58 23.1	0 57.8	2.22	.967 768	9 00 45
18	16 44 09.60	72.23	32.65	11 58 31.2	0 56.9	2.22	.957 159	8 58 01
19	16 45 21.83	71.89	32.67	11 58 34.8	0 56.0	2.23	.946 419	8 55 17
20	16 46 33.72	71.54	+0 32.70	-11 58 33.9	-0 55.1	2.24	3.935 548	8 52 32
21	16 47 45.26 ⁺	71.18	32.72	11 58 28.5	0 54.2	2.24	.924 549	8 49 48
22	16 48 56.44	70.80	32.74	11 58 18.7	0 53.3	2.25	.913 422	8 47 03
23	16 50 07.24	70.43	32.77	11 58 04.3	0 52.4	2.26	.902 169	8 44 17
24	16 51 17.67	70.03	32.79	11 57 45.4	0 51.5	2.26	.890 792	8 41 31
25	16 52 27.70	69.63	+0 32.82	-11 57 22.1	-0 50.6	2.27	3.879 290	8 38 45
26	16 53 37.33	69.22	32.86	11 56 54.2	0 49.7	2.28	.867 667	8 35 58
27	16 54 46.55	68.80	32.89	11 56 21.9	0 48.9	2.28	.855 924	8 33 11
28	16 55 55.35	68.36	32.91	11 55 45.0	0 48.0	2.29	.844 063	8 30 23
29	16 57 03.71	67.92	32.94	11 55 03.7	0 47.2	2.30	.832 085	8 27 35
30*	16 58 11.63	67.46	+0 32.96	-11 54 17.9	-0 46.4	2.30	3.819 994	8 24 47
Feb. 1	16 59 19.09	67.01	32.98	11 53 27.7	0 45.6	2.31	.807 791	8 21 58
2	17 00 26.10	66.53	33.00	11 52 33.0	0 44.7	2.32	.795 479	8 19 09
3	17 01 32.63	66.05	33.02	11 51 33.9	0 43.9	2.33	.783 060	8 16 19
4	17 02 38.68	65.56	33.03	11 50 30.3	0 43.0	2.33	.770 535	8 13 28
5	17 03 44.24	65.07	+0 33.05	-11 49 22.3	-0 42.2	2.34	3.757 908	8 10 38
6	17 04 49.31	64.55	33.07	11 48 10.0	0 41.3	2.35	.745 180	8 07 46
7	17 05 53.86	64.05	33.10	11 46 53.3	0 40.5	2.36	.732 353	8 04 55
8	17 06 57.91	63.51	33.12	11 45 32.2	0 39.6	2.37	.719 429	8 02 02
9	17 08 01.42	62.98	33.14	11 44 06.7	0 38.8	2.38	.706 411	7 59 09
10	17 09 04.40	62.44	+0 33.17	-11 42 37.0	-0 38.0	2.38	3.693 301	7 56 16
11	17 10 06.84	61.89	33.19	11 41 02.9	0 37.2	2.39	.680 100	7 53 22
12	17 11 08.73	61.33	33.21	11 39 24.6	0 36.5	2.40	.666 810	7 50 28
13	17 12 10.06	60.75	33.23	11 37 41.9	0 35.7	2.41	.653 434	7 47 33
14*	17 13 10.81	60.18	33.25	11 35 55.1	0 34.9	2.42	.639 973	7 44 37
15	17 14 10.99	59.58	+0 33.26	-11 34 04.0	-0 34.2	2.43	3.626 430	7 41 41
16	17 15 10.57		+0 33.28	-11 32 08.6	-0 33.4	2.44	3.612 806	7 38 44

Magnitude : Jan. 7, 11.2 ; Jan. 27, 11.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit	
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.				
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s	
Feb. 15	17 15 10.57 ⁺	58.99	+0 33.28	-11 32 08.6	-0 33.4	2.44	3.612 806	7 38 44
16	17 16 09.56 ⁺	58.37	33.29	11 30 09.1	0 32.7	2.45	.599 103	7 35 47
17	17 17 07.93	57.75	33.30	11 28 05.4	0 31.9	2.46	.585 323	7 32 49
18	17 18 05.68	57.12	33.32	11 25 57.6	0 31.1	2.46	.571 468	7 29 50
19	17 19 02.80	56.47	33.33	11 23 45.6	0 30.3	2.47	.557 539	7 26 51
20	17 19 59.27 ⁺	55.81	+0 33.35	-11 21 29.5	-0 29.6	2.48	3.543 540	7 23 51
21	17 20 55.08 ⁺	55.14	33.37	11 19 09.4	0 28.8	2.49	.529 472	7 20 50
22	17 21 50.22	54.46	33.40	11 16 45.1	0 28.1	2.50	.515 338	7 17 49
23	17 22 44.68	53.76	33.42	11 14 16.9	0 27.4	2.51	.501 139	7 14 47
24	17 23 38.44	53.05	33.44	11 11 44.6	0 26.7	2.52	.486 879	7 11 45
25	17 24 31.49 ⁺	52.34	+0 33.46	-11 09 08.4	-0 26.1	2.54	3.472 560	7 08 41
26	17 25 23.83	51.59	33.47	11 06 28.2	0 25.4	2.55	.458 185	7 05 37
27*	17 26 15.42	50.85	33.48	11 03 44.2	0 24.7	2.56	.443 757	7 02 32
28	17 27 06.27	50.10	33.50	11 00 56.2	0 24.1	2.57	.429 279	6 59 27
29	17 27 56.37	49.32	33.50	10 58 04.4	0 23.4	2.58	.414 754	6 56 21
Mar. 1	17 28 45.69 ⁺	48.54	+0 33.51	-10 55 08.9	-0 22.7	2.59	3.400 185	6 53 14
2	17 29 34.23	47.76	33.53	10 52 09.6	0 22.1	2.60	.385 575	6 50 06
3	17 30 21.99	46.94	33.54	10 49 06.6	0 21.4	2.61	.370 927	6 46 57
4	17 31 08.93	46.14	33.55	10 45 59.9	0 20.8	2.62	.356 244	6 43 48
5	17 31 55.07	45.32	33.56	10 42 49.6	0 20.1	2.63	.341 529	6 40 38
6	17 32 40.39 ⁺	44.47	+0 33.58	-10 39 35.7	-0 19.5	2.65	3.326 784	6 37 27
7	17 33 24.86 ⁺	43.64	33.60	10 36 18.3	0 18.9	2.66	.312 012	6 34 15
8	17 34 08.50	42.78	33.61	10 32 57.4	0 18.3	2.67	.297 217	6 31 02
9	17 34 51.28	41.91	33.63	10 29 33.0	0 17.8	2.68	.282 402	6 27 48
10	17 35 33.19	41.03	33.64	10 26 05.3	0 17.2	2.69	.267 568	6 24 34
11	17 36 14.22 ⁺	40.15	+0 33.65	-10 22 34.2	-0 16.7	2.71	3.252 719	6 21 19
12	17 36 54.37	39.24	33.66	10 18 59.8	0 16.2	2.72	.237 858	6 18 03
13*	17 37 33.61	38.33	33.67	10 15 22.2	0 15.7	2.73	.222 986	6 14 45
14	17 38 11.94	37.41	33.67	10 11 41.3	0 15.1	2.74	.208 108	6 11 27
15	17 38 49.35	36.48	33.68	10 07 57.4	0 14.6	2.76	.193 225	6 08 09
16	17 39 25.83 ⁺	35.52	+0 33.69	-10 04 10.3	-0 14.1	2.77	3.178 341	6 04 49
17	17 40 01.35	34.57	33.70	10 00 20.2	0 13.6	2.78	.163 458	6 01 28
18	17 40 35.92	33.58	33.71	9 56 27.0	0 13.1	2.80	.148 579	5 58 06
19	17 41 09.50	32.60	33.72	9 52 31.0	0 12.6	2.81	.133 707	5 54 43
20	17 41 42.10	31.60	33.74	9 48 32.1	0 12.1	2.82	.118 845	5 51 20
21	17 42 13.70 ⁺	30.58	+0 33.75	-9 44 30.3	-0 11.7	2.84	3.103 996	5 47 55
22	17 42 44.28	29.54	33.77	9 40 25.9	0 11.3	2.85	.089 164	5 44 29
23	17 43 13.82	28.51	33.78	9 36 18.7	0 10.9	2.86	.074 352	5 41 03
24	17 43 42.33	27.44	33.79	9 32 08.9	0 10.5	2.88	.059 564	5 37 35
25	17 44 09.77	26.38	33.80	9 27 56.6	0 10.2	2.89	.044 803	5 34 06
26*	17 44 36.15 ⁺	25.29	+0 33.80	-9 23 41.8	-0 09.8	2.91	3.030 074	5 30 36
27	17 45 01.44	24.20	33.81	9 19 24.6	0 09.5	2.92	.015 380	5 27 05
28	17 45 25.64	23.10	33.81	9 15 05.1	0 09.1	2.93	3.000 725	5 23 33
29	17 45 48.74	21.98	33.82	9 10 43.4	0 08.8	2.95	.2986 112	5 20 00
30	17 46 10.72	20.85	33.82	9 06 19.6	0 08.4	2.96	.971 547	5 16 26
31	17 46 31.57 ⁺	19.72	+0 33.83	-9 01 53.7	-0 08.1	2.98	2.957 032	5 12 50
Apr. 1	17 46 51.29		+0 33.84	-8 57 25.8	-0 07.8	2.99	2.942 572	5 09 14

Magnitude : Feb. 16, 10.9 ; Mar. 7, 10.7 ; Mar. 27, 10.5

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension			Declination			Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0		App. - Astr.	Astrometric 1950.0		App. - Astr.			
	^h ^m ^s	^s	^m ^s	[°] ['] ["]	["]	["]			^h ^m ^s
Apr. 1	17 46 51.29	18.58	+0 33.84	- 8 57 25.8	+269.7	-0 07.8	2.99	2.942 572	5 09 14
2	17 47 09.87	17.43	33.85	8 52 56.1	271.6	0 07.5	3.01	.928 169	5 05 36
3	17 47 27.30	16.26	33.86	8 48 24.5	273.2	0 07.2	3.02	.913 829	5 01 57
4	17 47 43.56	15.08	33.88	8 43 51.3	274.9	0 07.0	3.04	.899 555	4 58 17
5	17 47 58.64	13.91	33.89	8 39 16.4	276.4	0 06.8	3.05	.885 349	4 54 36
6	17 48 12.55		+0 33.90	- 8 34 40.0	+277.8	-0 06.6	3.07	2.871 217	4 50 54
7	17 48 25.28	12.73	33.91	8 30 02.2	279.1	0 06.4	3.08	.857 162	4 47 10
8	17 48 36.80	11.52	33.91	8 25 23.1	280.3	0 06.3	3.10	.843 187	4 43 26
9	17 48 47.13	10.33	33.92	8 20 42.8	281.4	0 06.1	3.11	.829 296	4 39 40
10*	17 48 56.24	9.11	33.92	8 16 01.4	282.5	0 06.0	3.13	.815 492	4 35 53
11	17 49 04.13	7.89	+0 33.92	- 8 11 18.9	+283.4	-0 05.8	3.14	2.801 779	4 32 04
12	17 49 10.81	6.68	33.92	8 06 35.5	284.2	0 05.7	3.16	.788 162	4 28 15
13	17 49 16.24	5.43	33.93	8 01 51.3	284.8	0 05.6	3.17	.774 641	4 24 24
14	17 49 20.43	4.19	33.94	7 57 06.5	285.5	0 05.4	3.19	.761 223	4 20 32
15	17 49 23.38	2.95	33.95	7 52 21.0	286.0	0 05.3	3.20	.747 910	4 16 39
16	17 49 25.06	1.68	+0 33.96	- 7 47 35.0	+286.3	-0 05.3	3.22	2.734 706	4 12 45
17	17 49 25.48	0.42	33.97	7 42 48.7	286.5	0 05.2	3.23	.721 615	4 08 49
18	17 49 24.63	0.85	33.99	7 38 02.2	286.7	0 05.2	3.25	.708 641	4 04 52
19	17 49 22.50	2.13	34.00	7 33 15.5	286.6	0 05.3	3.27	.695 788	4 00 54
20	17 49 19.08	3.42	34.01	7 28 28.9	286.5	0 05.3	3.28	.683 061	3 56 54
21	17 49 14.38	4.70	+0 34.01	- 7 23 42.4	+286.2	-0 05.4	3.30	2.670 464	3 52 53
22*	17 49 08.38	6.00	34.02	7 18 56.2	285.8	0 05.5	3.31	.658 001	3 48 51
23	17 49 01.09	7.29	34.02	7 14 10.4	285.1	0 05.5	3.33	.645 677	3 44 48
24	17 48 52.50	8.59	34.02	7 09 25.3	284.5	0 05.6	3.34	.633 496	3 40 43
25	17 48 42.61	9.89	34.02	7 04 40.8	283.5	0 05.7	3.36	.621 463	3 36 37
26	17 48 31.43	11.18	+0 34.03	- 6 59 57.3	+282.6	-0 05.8	3.37	2.609 582	3 32 30
27	17 48 18.96	12.47	34.03	6 55 14.7	281.3	0 05.9	3.39	.597 857	3 28 22
28	17 48 05.20	13.76	34.04	6 50 33.4	280.1	0 06.0	3.40	.586 293	3 24 12
29	17 47 50.15	15.05	34.05	6 45 53.3	278.5	0 06.2	3.42	.574 894	3 20 01
30	17 47 33.82	16.33	34.06	6 41 14.8	276.9	0 06.4	3.43	.563 664	3 15 49
		17.59							
May 1	17 47 16.23	18.87	+0 34.07	- 6 36 37.9	+275.1	-0 06.6	3.45	2.552 607	3 11 35
2	17 46 57.36	20.11	34.08	6 32 02.8	273.1	0 06.8	3.46	.541 727	3 07 20
3	17 46 37.25	21.37	34.09	6 27 29.7	271.0	0 07.1	3.48	.531 029	3 03 04
4	17 46 15.88	22.60	34.10	6 22 58.7	268.7	0 07.4	3.49	.520 515	2 58 47
5	17 45 53.28	23.83	34.10	6 18 30.0	266.3	0 07.7	3.51	.510 190	2 54 28
6	17 45 29.45	25.04	+0 34.10	- 6 14 03.7	+263.6	-0 08.0	3.52	2.500 057	2 50 09
7*	17 45 04.41	26.24	34.11	6 09 40.1	260.9	0 08.3	3.53	.490 120	2 45 48
8	17 44 38.17	27.42	34.11	6 05 19.2	258.0	0 08.6	3.55	.480 382	2 41 26
9	17 44 10.75	28.60	34.11	6 01 01.2	254.8	0 09.0	3.56	.470 847	2 37 02
10	17 43 42.15	29.75	34.11	5 56 46.4	251.6	0 09.3	3.58	.461 519	2 32 38
11	17 43 12.40	30.89	+0 34.12	- 5 52 34.8	+248.1	-0 09.6	3.59	2.452 399	2 28 12
12	17 42 41.51	32.02	34.13	5 48 26.7	244.6	0 10.0	3.60	.443 492	2 23 45
13	17 42 09.49	33.13	34.14	5 44 22.1	240.8	0 10.4	3.62	.434 801	2 19 18
14	17 41 36.36	34.22	34.15	5 40 21.3	236.9	0 10.8	3.63	.426 330	2 14 49
15	17 41 02.14	35.29	34.17	5 36 24.4	232.8	0 11.2	3.64	.418 081	2 10 19
16	17 40 26.85	36.34	+0 34.18	- 5 32 31.6	+228.6	-0 11.7	3.65	2.410 058	2 05 48
17	17 39 50.51		+0 34.18	- 5 28 43.0		-0 12.2	3.66	2.402 265	2 01 15

Magnitude: Apr. 16, 10.3; May 6, 10.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit	
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.				
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s	
May 17	17 39 50.51 ^s	+0 34.18	- 5 28 43.0 ["]	+224.0	-0 12.2	3.66	2.402 265	2 01 15
18	17 39 13.14	37.37	5 24 59.0	219.5	0 12.7	3.68	.394 706	1 56 42
19*	17 38 34.77	34.19	5 21 19.5	214.7	0 13.2	3.69	.387 383	1 52 08
20	17 37 55.42	34.19	5 17 44.8	209.7	0 13.7	3.70	.380 300	1 47 33
21	17 37 15.12	34.20	5 14 15.1	204.5	0 14.3	3.71	.373 462	1 42 57
22	17 36 33.90	+0 34.20	- 5 10 50.6	+199.3	-0 14.8	3.72	2.366 869	1 38 20
23	17 35 51.79	34.20	5 07 31.3	193.7	0 15.3	3.73	.360 527	1 33 42
24	17 35 08.82	34.21	5 04 17.6	188.1	0 15.8	3.74	.354 437	1 29 04
25	17 34 25.03	34.21	5 01 09.5	182.3	0 16.4	3.75	.348 603	1 24 24
26	17 33 40.45	34.22	4 58 07.2	176.3	0 16.9	3.76	.343 027	1 19 44
27	17 32 55.13	+0 34.23	- 4 55 10.9	+170.3	-0 17.5	3.77	2.337 711	1 15 03
28	17 32 09.09	34.24	4 52 20.6	163.9	0 18.1	3.77	.332 658	1 10 21
29	17 31 22.38	34.25	4 49 36.7	157.6	0 18.7	3.78	.327 869	1 05 39
30	17 30 35.04	34.25	4 46 59.1	151.0	0 19.3	3.79	.323 347	1 00 56
31	17 29 47.10	34.26	4 44 28.1	144.3	0 20.0	3.80	.319 093	0 56 12
June 1	17 28 58.61	+0 34.26	- 4 42 03.8	+137.5	-0 20.7	3.80	2.315 108	0 51 28
2	17 28 09.62	34.27	4 39 46.3	130.7	0 21.3	3.81	.311 394	0 46 44
3*	17 27 20.15	34.27	4 37 35.6	123.6	0 22.0	3.81	.307 952	0 41 58
4	17 26 30.27	34.27	4 35 32.0	116.5	0 22.6	3.82	.304 783	0 37 13
5	17 25 40.00	34.27	4 33 35.5	109.2	0 23.3	3.82	.301 886	0 32 27
6	17 24 49.40	+0 34.27	- 4 31 46.3	+101.9	-0 23.9	3.83	2.299 264	0 27 41
7	17 23 58.50	34.28	4 30 04.4	94.6	0 24.5	3.83	.296 916	0 22 54
8	17 23 07.36	34.28	4 28 29.8	87.0	0 25.2	3.84	.294 843	0 18 08
9	17 22 16.00	34.29	4 27 02.8	79.5	0 25.8	3.84	.293 044	0 13 21
10	17 21 24.48	34.31	4 25 43.3	71.9	0 26.5	3.84	.291 520	0 08 34
11	17 20 32.83	+0 34.32	- 4 24 31.4	+64.2	-0 27.2	3.84	2.290 271	{ 0 03 46 } { 23 58 59 }
12	17 19 41.11	34.33	4 23 27.2	56.4	0 27.9	3.84	.289 297	23 54 12
13	17 18 49.34	34.34	4 22 30.8	48.6	0 28.6	3.85	.288 598	23 49 24
14	17 17 57.59	34.34	4 21 42.2	40.8	0 29.3	3.85	.288 174	23 44 37
15*	17 17 05.88	34.35	4 21 01.4	32.8	0 30.1	3.85	.288 025	23 39 50
16	17 16 14.27	+0 34.35	- 4 20 28.6	+24.9	-0 30.7	3.85	2.288 151	23 35 03
17	17 15 22.80	34.35	4 20 03.7	16.9	0 31.4	3.85	.288 552	23 30 16
18	17 14 31.52	34.35	4 19 46.8	9.0	0 32.1	3.85	.289 226	23 25 29
19	17 13 40.47	34.35	4 19 37.8	+0.9	0 32.7	3.84	.290 174	23 20 43
20	17 12 49.70	34.36	4 19 36.9	-7.1	0 33.3	3.84	.291 394	23 15 57
21	17 11 59.26	+0 34.36	- 4 19 44.0	-15.2	-0 34.0	3.84	2.292 885	23 11 11
22	17 11 09.18	34.37	4 19 59.2	23.1	0 34.6	3.84	.294 645	23 06 26
23	17 10 19.53	34.37	4 20 22.3	31.2	0 35.3	3.83	.296 674	23 01 41
24	17 09 30.33	34.38	4 20 53.5	39.0	0 35.9	3.83	.298 968	22 56 57
25	17 08 41.64	34.39	4 21 32.5	47.1	0 36.6	3.82	.301 527	22 52 13
26	17 07 53.50	+0 34.40	- 4 22 19.6	-54.9	-0 37.2	3.82	2.304 348	22 47 30
27	17 07 05.94	34.40	4 23 14.5	62.7	0 37.9	3.81	.307 429	22 42 47
28	17 06 19.01	34.41	4 24 17.2	70.5	0 38.5	3.81	.310 767	22 38 05
29	17 05 32.75	34.41	4 25 27.7	78.3	0 39.1	3.80	.314 359	22 33 24
30*	17 04 47.20	34.42	4 26 46.0	85.8	0 39.7	3.80	.318 203	22 28 43
July 1	17 04 02.39	+0 34.42	- 4 28 11.8	-93.5	-0 40.3	3.79	2.322 296	22 24 04
2	17 03 18.36	+0 34.42	- 4 29 45.3		-0 40.9	3.78	2.326 633	22 19 25

Magnitude : May 26, 9.9 ; June 15, 9.9

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension			Declination			Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0		App. - Astr.	Astrometric 1950.0		App. - Astr.			
	h m s	s	m s	° ' " "	"	° ' " "			h m s
July 1	17 04 02.39	44.03	+0 34.42	4 28 11.8	93.5	-0 40.3	3.79	2.322 296	22 24 04
2	17 03 18.36	43.22	34.42	4 29 45.3	100.9	0 40.9	3.78	3.26 633	22 19 25
3	17 02 35.14	42.37	34.42	4 31 26.2	108.2	0 41.4	3.78	3.31 213	22 14 47
4	17 01 52.77	41.49	34.42	4 33 14.4	115.6	0 42.0	3.77	3.36 032	22 10 09
5	17 01 11.28	40.59	34.42	4 35 10.0	122.7	0 42.5	3.76	3.41 086	22 05 33
6	17 00 30.69	39.67	+0 34.43	4 37 12.7	129.7	-0 43.0	3.75	2.346 372	22 00 58
7	16 59 51.02	38.70	34.44	4 39 22.4	136.8	0 43.5	3.74	3.51 886	21 56 23
8	16 59 12.32	37.72	34.46	4 41 39.2	143.6	0 44.0	3.73	3.57 626	21 51 50
9	16 58 34.60	36.72	34.47	4 44 02.8	150.3	0 44.5	3.72	3.63 587	21 47 17
10	16 57 57.88	35.69	34.48	4 46 33.1	157.0	0 45.0	3.71	3.69 766	21 42 46
11	16 57 22.19	34.64	+0 34.49	4 49 10.1	163.4	-0 45.5	3.70	2.376 161	21 38 15
12*	16 56 47.55	33.57	34.49	4 51 53.5	169.9	0 46.0	3.69	3.82 767	21 33 46
13	16 56 13.98	32.47	34.49	4 54 43.4	176.1	0 46.5	3.68	3.89 583	21 29 18
14	16 55 41.51	31.36	34.49	4 57 39.5	182.4	0 46.9	3.67	3.96 603	21 24 50
15	16 55 10.15	30.23	34.50	5 00 41.9	188.3	0 47.3	3.66	4.03 825	21 20 24
16	16 54 39.92	29.07	+0 34.50	5 03 50.2	194.2	-0 47.7	3.65	2.411 246	21 15 59
17	16 54 10.85	27.91	34.50	5 07 04.4	200.1	0 48.0	3.64	4.18 862	21 11 36
18	16 53 42.94	26.71	34.51	5 10 24.5	205.7	0 48.3	3.63	4.26 668	21 07 13
19	16 53 16.23	25.51	34.51	5 13 50.2	211.2	0 48.7	3.62	4.34 662	21 02 52
20	16 52 50.72	24.29	34.52	5 17 21.4	216.6	0 49.0	3.60	4.42 839	20 58 31
21	16 52 26.43	23.06	+0 34.53	5 20 58.0	221.8	-0 49.3	3.59	2.451 195	20 54 12
22	16 52 03.37	21.81	34.54	5 24 39.8	226.9	0 49.6	3.58	4.59 726	20 49 55
23	16 51 41.56	20.56	34.55	5 28 26.7	231.9	0 49.9	3.57	4.68 428	20 45 38
24	16 51 21.00	19.29	34.56	5 32 18.6	236.7	0 50.2	3.55	4.77 296	20 41 23
25	16 51 01.71	18.02	34.56	5 36 15.3	241.3	0 50.4	3.54	4.86 327	20 37 09
26	16 50 43.69	16.73	+0 34.57	5 40 16.6	245.9	-0 50.7	3.53	2.495 515	20 32 56
27*	16 50 26.96	15.44	34.57	5 44 22.5	250.2	0 50.9	3.51	5.04 857	20 28 45
28	16 50 11.52	14.15	34.57	5 48 32.7	254.4	0 51.1	3.50	5.14 348	20 24 35
29	16 49 57.37	12.86	34.57	5 52 47.1	258.5	0 51.3	3.49	5.23 984	20 20 26
30	16 49 44.51	11.55	34.58	5 57 05.6	262.5	0 51.4	3.47	5.33 760	20 16 18
31	16 49 32.96	10.25	+0 34.58	6 01 28.1	266.2	-0 51.5	3.46	2.543 671	20 12 12
Aug. 1	16 49 22.71	8.95	34.59	6 05 54.3	269.7	0 51.6	3.45	5.53 714	20 08 07
2	16 49 13.76	7.66	34.59	6 10 24.0	273.3	0 51.7	3.43	5.63 884	20 04 03
3	16 49 06.10	6.35	34.60	6 14 57.3	276.7	0 51.8	3.42	5.74 176	20 00 01
4	16 48 59.75	5.06	34.62	6 19 34.0	279.8	0 51.8	3.41	5.84 587	19 56 00
5	16 48 54.69	3.77	+0 34.63	6 24 13.8	282.8	-0 51.9	3.39	2.595 112	19 52 00
6	16 48 50.92	2.49	34.64	6 28 56.6	285.8	0 51.9	3.38	6.05 749	19 48 01
7	16 48 48.43	1.20	34.65	6 33 42.4	288.5	0 52.0	3.36	6.16 492	19 44 04
8*	16 48 47.23	0.08	34.66	6 38 30.9	291.2	0 52.0	3.35	6.27 338	19 40 08
9	16 48 47.31	1.35	34.66	6 43 22.1	293.7	0 52.0	3.34	6.38 285	19 36 13
10	16 48 48.66	2.62	+0 34.67	6 48 15.8	296.2	-0 52.0	3.32	2.649 327	19 32 19
11	16 48 51.28	3.89	34.67	6 53 12.0	298.3	0 51.9	3.31	6.60 463	19 28 27
12	16 48 55.17	5.16	34.67	6 58 10.3	300.6	0 51.8	3.29	6.71 688	19 24 36
13	16 49 00.33	6.41	34.68	7 03 10.9	302.6	0 51.7	3.28	6.82 999	19 20 46
14	16 49 06.74	7.67	34.68	7 08 13.5	304.4	0 51.6	3.27	6.94 392	19 16 58
15	16 49 14.41	8.92	+0 34.69	7 13 17.9	306.3	-0 51.4	3.25	2.705 864	19 13 11
16	16 49 23.33		+0 34.70	7 18 24.2		0 51.3	3.24	7.17 411	19 09 25

Magnitude: July 5, 9.9; July 25, 10.0; Aug. 14, 10.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1960
FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	[°] ['] ["]	["]		^h ^m ^s
Aug. 16	16 49 23.33 + ^s 10.16	+0 34.70	- 7 18 24.2 -307.9	-0 51.3	3.24	2.717 411	19 09 25
17	16 49 33.49 11.41	34.71	7 23 32.1 309.5	0 51.1	3.23	.729 029	19 05 40
18	16 49 44.90 12.64	34.72	7 28 41.6 310.9	0 50.9	3.21	.740 714	19 01 56
19	16 49 57.54 13.86	34.73	7 33 52.5 312.2	0 50.7	3.20	.752 463	18 58 14
20	16 50 11.40 15.08	34.74	7 39 04.7 313.3	0 50.6	3.18	.764 272	18 54 33
21	16 50 26.48 + 16.30	+0 34.75	- 7 44 18.0 -314.5	-0 50.3	3.17	2.776 137	-18 50 53
22	16 50 42.78 17.50	34.76	7 49 32.5 315.4	0 50.1	3.16	.788 054	18 47 14
23*	16 51 00.28 18.70	34.76	7 54 47.9 316.2	0 49.9	3.14	.800 020	18 43 36
24	16 51 18.98 19.88	34.76	8 00 04.1 317.0	0 49.6	3.13	.812 031	18 40 00
25	16 51 38.86 21.06	34.77	8 05 21.1 317.5	0 49.3	3.12	.824 083	18 36 25
26	16 51 59.92 + 22.22	+0 34.77	- 8 10 38.6 -318.1	-0 49.0	3.10	2.836 172	18 32 51
27	16 52 22.14 23.39	34.77	8 15 56.7 318.4	0 48.6	3.09	.848 295	18 29 18
28	16 52 45.53 24.53	34.78	8 21 15.1 318.7	0 48.3	3.08	.860 449	18 25 46
29	16 53 10.06 25.66	34.79	8 26 33.8 318.9	0 47.9	3.06	.872 628	18 22 15
30	16 53 35.72 26.79	34.80	8 31 52.7 318.9	0 47.5	3.05	.884 831	18 18 46
31	16 54 02.51 + 27.89	+0 34.81	- 8 37 11.6 -318.9	-0 47.1	3.04	2.897 053	18 15 18
Sept. 1	16 54 30.40 28.99	34.83	8 42 30.5 318.8	0 46.7	3.03	.909 292	18 11 50
2	16 54 59.39 30.08	34.84	8 47 49.3 318.5	0 46.3	3.01	.921 545	18 08 24
3	16 55 29.47 31.16	34.86	8 53 07.8 318.2	0 45.8	3.00	.933 808	18 04 59
4	16 56 00.63 32.21	34.87	8 58 26.0 317.8	0 45.4	2.99	.946 080	18 01 35
5*	16 56 32.84 + 33.27	+0 34.87	- 9 03 43.8 -317.3	-0 45.0	2.98	2.958 357	17 58 12
6	16 57 06.11 34.31	34.88	9 09 01.1 316.6	0 44.5	2.96	.970 636	17 54 50
7	16 57 40.42 35.34	34.88	9 14 17.7 316.0	0 44.0	2.95	.982 916	17 51 29
8	16 58 15.76 36.36	34.89	9 19 33.7 315.3	0 43.5	2.94	2.995 194	17 48 09
9	16 58 52.12 37.38	34.89	9 24 49.0 314.3	0 42.9	2.93	3.007 467	17 44 50
10	16 59 29.50 + 38.38	+0 34.90	- 9 30 03.3 -313.5	-0 42.3	2.92	3.019 733	17 41 32
11	17 00 07.88 39.37	34.91	9 35 16.8 312.4	0 41.7	2.90	.031 989	17 38 15
12	17 00 47.25 40.36	34.92	9 40 29.2 311.4	0 41.1	2.89	.044 233	17 34 59
13	17 01 27.61 41.34	34.93	9 45 40.6 310.2	0 40.5	2.88	.056 461	17 31 44
14	17 02 08.95 42.31	34.94	9 50 50.8 308.9	0 39.9	2.87	.068 671	17 28 30
15	17 02 51.26 + 43.26	+0 34.95	- 9 55 59.7 -307.6	-0 39.3	2.86	3.080 861	17 25 17
16	17 03 34.52 44.22	34.96	10 01 07.3 306.2	0 38.7	2.85	.093 027	17 22 04
17	17 04 18.74 45.15	34.97	10 06 13.5 304.7	0 38.1	2.83	.105 168	17 18 53
18	17 05 03.89 46.08	34.98	10 11 18.2 303.1	0 37.4	2.82	.117 279	17 15 43
19*	17 05 49.97 47.01	34.99	10 16 21.3 301.5	0 36.8	2.81	.129 359	17 12 33
20	17 06 36.98 + 47.91	+0 34.99	- 10 21 22.8 -299.8	-0 36.1	2.80	3.141 404	17 09 25
21	17 07 24.89 48.81	35.00	10 26 22.6 298.0	0 35.4	2.79	.153 413	17 06 17
22	17 08 13.70 49.70	35.00	10 31 20.6 296.1	0 34.7	2.78	.165 381	17 03 11
23	17 09 03.40 50.58	35.00	10 36 16.7 294.1	0 33.9	2.77	.177 307	17 00 05
24	17 09 53.98 51.45	35.01	10 41 10.8 292.2	0 33.1	2.76	.189 187	16 57 00
25	17 10 45.43 + 52.30	+0 35.02	- 10 46 03.0 -290.0	-0 32.3	2.75	3.201 020	16 53 56
26	17 11 37.73 53.15	35.03	10 50 53.0 288.0	0 31.5	2.74	.212 802	16 50 53
27	17 12 30.88 53.98	35.05	10 55 41.0 285.6	0 30.7	2.73	.224 532	16 47 50
28	17 13 24.86 54.80	35.06	11 00 26.6 283.4	0 30.0	2.72	.236 206	16 44 49
29	17 14 19.66 55.61	35.08	11 05 10.0 281.0	0 29.2	2.71	.247 823	16 41 48
30	17 15 15.27 + 56.41	+0 35.09	- 11 09 51.0 -278.6	-0 28.4	2.70	3.259 381	16 38 48
Oct. 1	17 16 11.68 57.22	+0 35.10	- 11 14 29.6 276.2	-0 27.6	2.69	3.270 878	16 35 49

Magnitude : Sept. 3, 10.3 ; Sept. 23, 10.5

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1960

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Oct. 1	^{h m s} 17 16 11.68 ^s	^{m s} +0 35.10	^{° ' "} -11 14 29.6	^{° ' "} -0 27.6	2.69	3.270 878	^{h m s} 16 35 49
2	17 17 08.88 ^{57.20}	35.11	11 19 05.7 ^{-276.1}	0 26.7	2.68	.282 312	16 32 50
3*	17 18 06.85 ^{57.97}	35.11	11 23 39.3 ^{273.6}	0 25.9	2.67	.293 682	16 29 52
4	17 19 05.60 ^{58.75}	35.12	11 28 10.2 ^{270.9}	0 25.1	2.66	.304 985	16 26 56
5	17 20 05.10 ^{59.50}	35.12	11 32 38.5 ^{268.3}	0 24.2	2.65	.316 220	16 23 59
6	17 21 05.35 ^{60.25}	+0 35.13	-11 37 04.1 ^{265.6}	-0 23.2	2.65	3.327 386	16 21 04
7	17 22 06.34 ^{60.99}	35.13	11 41 26.9 ^{-262.8}	0 22.3	2.64	.338 481	16 18 09
8	17 23 08.07 ^{61.73}	35.14	11 45 46.9 ^{260.0}	0 21.4	2.63	.349 503	16 15 15
9	17 24 10.52 ^{62.45}	35.15	11 50 04.0 ^{257.1}	0 20.4	2.62	.360 451	16 12 22
10	17 25 13.69 ^{63.17}	35.16	11 54 18.2 ^{254.2}	0 19.4	2.61	.371 322	16 09 29
11	17 26 17.57 ^{63.88}	+0 35.18	-11 58 29.4 ^{251.2}	-0 18.5	2.60	3.382 115	16 06 38
12	17 27 22.15 ^{64.58}	35.19	12 02 37.5 ^{-248.1}	0 17.5	2.59	.392 829	16 03 46
13	17 28 27.43 ^{65.28}	35.20	12 06 42.6 ^{245.1}	0 16.6	2.59	.403 460	16 00 56
14	17 29 33.39 ^{65.96}	35.21	12 10 44.5 ^{241.9}	0 15.6	2.58	.414 008	15 58 06
15	17 30 40.03 ^{66.64}	35.22	12 14 43.2 ^{238.7}	0 14.7	2.57	.424 470	15 55 17
16	17 31 47.34 ^{67.31}	+0 35.23	-12 18 38.7 ^{235.5}	-0 13.7	2.56	3.434 844	15 52 29
17*	17 32 55.32 ^{67.98}	35.23	12 22 30.8 ^{-232.1}	0 12.7	2.56	.445 129	15 49 41
18	17 34 03.95 ^{68.63}	35.23	12 26 19.6 ^{228.8}	0 11.7	2.55	.455 323	15 46 54
19	17 35 13.22 ^{69.27}	35.24	12 30 05.0 ^{225.4}	0 10.6	2.54	.465 423	15 44 07
20	17 36 23.14 ^{69.92}	35.24	12 33 46.9 ^{221.9}	0 09.6	2.53	.475 428	15 41 21
21	17 37 33.68 ^{70.54}	+0 35.25	-12 37 25.4 ^{218.5}	-0 08.5	2.53	3.485 336	15 38 36
22	17 38 44.84 ^{71.16}	35.25	12 41 00.3 ^{-214.9}	0 07.4	2.52	.495 144	15 35 51
23	17 39 56.62 ^{71.78}	35.26	12 44 31.5 ^{211.2}	0 06.3	2.51	.504 852	15 33 07
24	17 41 08.99 ^{72.37}	35.28	12 47 59.1 ^{207.6}	0 05.2	2.50	.514 456	15 30 24
25	17 42 21.96 ^{72.97}	35.29	12 51 23.1 ^{204.0}	0 04.1	2.50	.523 957	15 27 41
26	17 43 35.50 ^{73.54}	+0 35.30	-12 54 43.2 ^{200.1}	-0 03.0	2.49	3.533 351	15 24 58
27	17 44 49.62 ^{74.12}	35.32	12 57 59.6 ^{-196.4}	0 01.9	2.49	.542 638	15 22 17
28	17 46 04.30 ^{74.68}	35.33	13 01 12.2 ^{192.6}	-0 00.9	2.48	.551 817	15 19 36
29	17 47 19.53 ^{75.23}	35.33	13 04 20.9 ^{188.7}	+0 00.2	2.47	.560 886	15 16 55
30	17 48 35.31 ^{75.78}	35.34	13 07 25.7 ^{184.8}	0 01.3	2.47	.569 844	15 14 15
31*	17 49 51.62 ^{76.31}	+0 35.34	-13 10 26.5 ^{180.8}	+0 02.5	2.46	3.578 691	15 11 35
Nov. 1	17 51 08.47 ^{76.85}	35.34	13 13 23.4 ^{-176.9}	0 03.6	2.45	.587 425	15 08 56
2	17 52 25.83 ^{77.36}	35.34	13 16 16.3 ^{172.9}	0 04.8	2.45	.596 045	15 06 17
3	17 53 43.70 ^{77.87}	35.35	13 19 05.1 ^{168.8}	0 06.0	2.44	.604 551	15 03 39
4	17 55 02.08 ^{78.38}	35.35	13 21 49.8 ^{164.7}	0 07.2	2.44	.612 942	15 01 02
5	17 56 20.97 ^{78.89}	+0 35.36	-13 24 30.4 ^{160.6}	+0 08.4	2.43	3.621 216	14 58 25
6	17 57 40.34 ^{79.37}	35.37	13 27 06.8 ^{-156.4}	0 09.6	2.43	.629 373	14 55 48
7	17 59 00.20 ^{79.86}	35.38	13 29 39.1 ^{152.3}	0 10.8	2.42	.637 411	14 53 12
8	18 00 20.55 ^{80.35}	35.39	13 32 07.1 ^{148.0}	0 12.0	2.42	.645 329	14 50 36
9	18 01 41.36 ^{80.81}	35.40	13 34 30.9 ^{143.8}	0 13.2	2.41	.653 126	14 48 01
10	18 03 02.65 ^{81.29}	+0 35.41	-13 36 50.4 ^{139.5}	+0 14.4	2.40	3.660 801	14 45 27
11	18 04 24.39 ^{81.74}	35.41	13 39 05.6 ^{-135.2}	0 15.6	2.40	.668 353	14 42 52
12	18 05 46.60 ^{82.21}	35.42	13 41 16.4 ^{130.8}	0 16.8	2.40	.675 780	14 40 19
13	18 07 09.25 ^{82.65}	35.42	13 43 22.8 ^{126.4}	0 18.0	2.39	.683 082	14 37 45
14	18 08 32.34 ^{83.09}	35.42	13 45 24.8 ^{122.0}	0 19.2	2.39	.690 256	14 35 12
15*	18 09 55.86 ^{83.52}	+0 35.42	-13 47 22.4 ^{117.6}	+0 20.4	2.38	3.697 302	14 32 40
16	18 11 19.82 ^{83.96}	+0 35.42	-13 49 15.5 ^{-113.1}	+0 21.7	2.38	3.704 218	14 30 08

Magnitude : Oct. 13, 10.6 ; Nov. 2, 10.7 ; Nov. 22, 10.8

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Jan. 0	15 47 37.88 ^s	+0 32.76	-14 57 44.1	-1 38.6	3.11	2.827 815	9 12 45
1	15 49 40.57 ^{+122.69}	32.82	15 04 21.3	1 37.2	3.12	.819 510	9 10 51
2*	15 51 43.22 ^{122.65}	32.88	15 10 52.4	1 35.8	3.13	.811 134	9 08 58
3	15 53 45.84 ^{122.62}	32.93	15 17 17.7	1 34.4	3.14	.802 688	9 07 04
4	15 55 48.40 ^{122.56}	32.98	15 23 36.9	1 33.0	3.15	.794 173	9 05 10
	^{122.52}		^{373.2}				
5	15 57 50.92 ^{+122.45}	+0 33.04	-15 29 50.1	-1 31.5	3.16	2.785 589	9 03 16
6	15 59 53.37 ^{122.39}	33.09	15 35 57.2	1 30.0	3.17	.776 937	9 01 22
7	16 01 55.76 ^{122.33}	33.14	15 41 58.3	1 28.5	3.18	.768 219	8 59 28
8	16 03 58.09 ^{122.24}	33.19	15 47 53.4	1 27.0	3.19	.759 435	8 57 34
9	16 06 00.33 ^{122.17}	33.25	15 53 42.3	1 25.5	3.20	.750 585	8 55 40
10	16 08 02.50 ^{+122.08}	+0 33.31	-15 59 25.2	-1 24.0	3.21	2.741 670	8 53 46
11	16 10 04.58 ^{121.98}	33.37	16 05 02.0	1 22.5	3.22	.732 692	8 51 52
12	16 12 06.56 ^{121.89}	33.42	16 10 32.6	1 21.0	3.23	.723 649	8 49 57
13	16 14 08.45 ^{121.79}	33.48	16 15 57.1	1 19.5	3.24	.714 544	8 48 03
14	16 16 10.24 ^{121.67}	33.54	16 21 15.5	1 18.0	3.25	.705 376	8 46 08
15	16 18 11.91 ^{+121.55}	+0 33.59	-16 26 27.8	-1 16.5	3.26	2.696 146	8 44 14
16	16 20 13.46 ^{121.43}	33.64	16 31 33.9	1 15.0	3.28	.686 855	8 42 19
17*	16 22 14.89 ^{121.30}	33.69	16 36 33.9	1 13.5	3.29	.677 502	8 40 24
18	16 24 16.19 ^{121.15}	33.74	16 41 27.7	1 11.9	3.30	.668 088	8 38 29
19	16 26 17.34 ^{121.01}	33.79	16 46 15.4	1 10.4	3.31	.658 613	8 36 33
20	16 28 18.35 ^{+120.85}	+0 33.83	-16 50 57.0	-1 08.8	3.32	2.649 079	8 34 38
21	16 30 19.20 ^{120.68}	33.88	16 55 32.4	1 07.2	3.33	.639 484	8 32 42
22	16 32 19.88 ^{120.51}	33.93	17 00 01.7	1 05.6	3.35	.629 830	8 30 47
23	16 34 20.39 ^{120.32}	33.97	17 04 24.8	1 04.1	3.36	.620 117	8 28 51
24	16 36 20.71 ^{120.12}	34.03	17 08 41.8	1 02.5	3.37	.610 345	8 26 55
25	16 38 20.83 ^{+119.91}	+0 34.08	-17 12 52.7	-1 00.9	3.38	2.600 515	8 24 58
26	16 40 20.74 ^{119.69}	34.13	17 16 57.5	0 59.3	3.40	.590 628	8 23 02
27	16 42 20.43 ^{119.46}	34.19	17 20 56.2	0 57.8	3.41	.580 684	8 21 05
28	16 44 19.89 ^{119.22}	34.24	17 24 48.7	0 56.2	3.42	.570 685	8 19 08
29	16 46 19.11 ^{118.96}	34.29	17 28 35.2	0 54.7	3.44	.560 631	8 17 11
30*	16 48 18.07 ^{+118.70}	+0 34.33	-17 32 15.7	-0 53.1	3.45	2.550 523	8 15 13
31	16 50 16.77 ^{118.43}	34.37	17 35 50.1	0 51.5	3.47	.540 363	8 13 16
Feb. 1	16 52 15.20 ^{118.14}	34.41	17 39 18.5	0 49.9	3.48	.530 153	8 11 18
2	16 54 13.34 ^{117.85}	34.45	17 42 40.9	0 48.3	3.49	.519 891	8 09 19
3	16 56 11.19 ^{117.56}	34.48	17 45 57.4	0 46.7	3.51	.509 581	8 07 21
4	16 58 08.75 ^{+117.24}	+0 34.52	-17 49 07.9	-0 45.1	3.52	2.499 223	8 05 22
5	17 00 05.99 ^{116.92}	34.56	17 52 12.5	0 43.5	3.54	.488 818	8 03 23
6	17 02 02.91 ^{116.60}	34.61	17 55 11.3	0 41.9	3.55	.478 367	8 01 23
7	17 03 59.51 ^{116.27}	34.65	17 58 04.3	0 40.3	3.57	.467 870	7 59 23
8	17 05 55.78 ^{115.91}	34.69	18 00 51.5	0 38.6	3.58	.457 329	7 57 23
9	17 07 51.69 ^{+115.57}	+0 34.73	-18 03 33.0	-0 37.1	3.60	2.446 744	7 55 22
10	17 09 47.26 ^{115.20}	34.77	18 06 08.8	0 35.5	3.61	.436 116	7 53 22
11	17 11 42.46 ^{114.83}	34.81	18 08 38.9	0 33.9	3.63	.425 446	7 51 20
12	17 13 37.29 ^{114.45}	34.85	18 11 03.5	0 32.3	3.65	.414 735	7 49 19
13	17 15 31.74 ^{114.06}	34.88	18 13 22.5	0 30.8	3.66	.403 982	7 47 17
14*	17 17 25.80 ^{+113.65}	+0 34.91	-18 15 35.9	-0 29.2	3.68	2.393 190	7 45 14
15	17 19 19.45 ^{113.26}	+0 34.94	-18 17 44.0	-0 27.6	3.69	2.382 358	7 43 11

Magnitude : Jan. 7, 7.9 ; Jan. 27, 7.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	[°] ['] ["]			^h ^m ^s
Feb. 15	17 19 19.45 ^s	+0 34.94	-18 17 44.0	-0 27.6	3.69	2.382 358	7 43 11
16	17 21 12.70 ^{+113.25}	34.97	18 19 46.6 ^{-122.6}	0 26.0	3.71	371 486	7 41 08
17	17 23 05.52 ^{112.82}	35.00	18 21 44.0 ^{117.4}	0 24.4	3.73	360 576	7 39 05
18	17 24 57.90 ^{112.38}	35.03	18 23 36.0 ^{112.0}	0 22.8	3.75	349 627	7 37 00
19	17 26 49.84 ^{111.94}	35.06	18 25 22.8 ^{106.8}	0 21.2	3.76	338 641	7 34 56
20	17 28 41.31 ^{111.47}	+0 35.09	-18 27 04.4 ^{96.6}	-0 19.6	3.78	2.327 618	7 32 51
21	17 30 32.31 ^{+111.00}	35.13	18 28 41.0 ^{91.5}	0 18.0	3.80	316 559	7 30 45
22	17 32 22.81 ^{110.50}	35.17	18 30 12.5 ^{86.6}	0 16.4	3.82	305 464	7 28 39
23	17 34 12.81 ^{110.00}	35.20	18 31 39.1 ^{81.7}	0 14.9	3.84	294 335	7 26 33
24	17 36 02.30 ^{109.49}	35.23	18 33 00.8 ^{76.8}	0 13.4	3.86	283 172	7 24 26
25	17 37 51.25 ^{+108.40}	+0 35.26	-18 34 17.6 ^{72.2}	-0 11.8	3.87	2.271 977	7 22 18
26	17 39 39.65 ^{107.83}	35.29	18 35 29.8 ^{67.4}	0 10.3	3.89	260 751	7 20 10
27	17 41 27.48 ^{107.27}	35.32	18 36 37.2 ^{62.9}	0 08.8	3.91	249 495	7 18 02
28*	17 43 14.75 ^{106.67}	35.34	18 37 40.1 ^{58.3}	0 07.3	3.93	238 210	7 15 52
29	17 45 01.42 ^{106.07}	35.36	18 38 38.4 ^{54.0}	0 05.7	3.95	226 898	7 13 42
Mar. 1	17 46 47.49 ^{+105.46}	+0 35.38	-18 39 32.4 ^{49.6}	-0 04.2	3.97	2.215 561	7 11 32
2	17 48 32.95 ^{104.83}	35.40	18 40 22.0 ^{45.4}	0 02.6	3.99	204 199	7 09 21
3	17 50 17.78 ^{104.19}	35.42	18 41 07.4 ^{41.2}	-0 01.1	4.01	192 814	7 07 09
4	17 52 01.97 ^{103.54}	35.45	18 41 48.6 ^{37.2}	+0 00.4	4.04	181 407	7 04 57
5	17 53 45.51 ^{102.88}	35.47	18 42 25.8 ^{33.2}	0 02.0	4.06	169 979	7 02 44
6	17 55 28.39 ^{+102.20}	+0 35.50	-18 42 59.0 ^{29.4}	+0 03.5	4.08	2.158 532	7 00 30
7	17 57 10.59 ^{101.52}	35.52	18 43 28.4 ^{25.6}	0 05.0	4.10	147 066	6 58 16
8	17 58 52.11 ^{100.82}	35.55	18 43 54.0 ^{22.0}	0 06.4	4.12	135 583	6 56 01
9	18 00 32.93 ^{100.10}	35.57	18 44 16.0 ^{18.4}	0 07.9	4.14	124 084	6 53 45
10	18 02 13.03 ^{99.39}	35.59	18 44 34.4 ^{15.0}	0 09.3	4.17	112 569	6 51 29
11	18 03 52.42 ^{+98.65}	+0 35.61	-18 44 49.4 ^{11.6}	+0 10.8	4.19	2.101 040	6 49 12
12	18 05 31.07 ^{97.89}	35.63	18 45 01.0 ^{8.4}	0 12.2	4.21	089 498	6 46 54
13	18 07 08.96 ^{97.14}	35.64	18 45 09.4 ^{5.3}	0 13.6	4.24	077 944	6 44 35
14*	18 08 46.10 ^{96.36}	35.66	18 45 14.7 ^{2.3}	0 15.0	4.26	066 378	6 42 16
15	18 10 22.46 ^{95.56}	35.67	18 45 17.0 ^{+0.6}	0 16.4	4.28	054 801	6 39 56
16	18 11 58.02 ^{+94.76}	+0 35.68	-18 45 16.4 ^{+3.3}	+0 17.9	4.31	2.043 214	6 37 35
17	18 13 32.78 ^{93.93}	35.70	18 45 13.1 ^{5.9}	0 19.3	4.33	031 618	6 35 13
18	18 15 06.71 ^{93.10}	35.72	18 45 07.2 ^{8.5}	0 20.7	4.36	020 014	6 32 50
19	18 16 39.81 ^{92.22}	35.74	18 44 58.7 ^{10.9}	0 22.1	4.38	2.008 403	6 30 27
20	18 18 12.03 ^{91.36}	35.76	18 44 47.8 ^{13.1}	0 23.5	4.41	1.996 786	6 28 03
21	18 19 43.39 ^{+90.45}	+0 35.79	-18 44 34.7 ^{+15.3}	+0 24.9	4.43	1.985 164	6 25 37
22	18 21 13.84 ^{89.54}	35.81	18 44 19.4 ^{17.2}	0 26.2	4.46	973 538	6 23 11
23	18 22 43.38 ^{88.60}	35.83	18 44 02.2 ^{19.1}	0 27.5	4.49	961 910	6 20 44
24	18 24 11.98 ^{87.64}	35.84	18 43 43.1 ^{20.8}	0 28.8	4.51	950 281	6 18 16
25	18 25 39.62 ^{86.67}	35.86	18 43 22.3 ^{22.4}	0 30.0	4.54	938 653	6 15 47
26	18 27 06.29 ^{+85.68}	+0 35.87	-18 42 59.9 ^{+23.9}	+0 31.3	4.57	1.927 028	6 13 18
27*	18 28 31.97 ^{84.66}	35.88	18 42 36.0 ^{25.1}	0 32.6	4.60	915 407	6 10 47
28	18 29 56.63 ^{83.64}	35.89	18 42 10.9 ^{26.3}	0 33.8	4.62	903 792	6 08 15
29	18 31 20.27 ^{82.59}	35.90	18 41 44.6 ^{27.2}	0 35.1	4.65	892 185	6 05 42
30	18 32 42.86 ^{81.54}	35.92	18 41 17.4 ^{28.1}	0 36.4	4.68	880 588	6 03 08
31	18 34 04.40 ^{+80.45}	+0 35.93	-18 40 49.3 ^{+28.9}	+0 37.6	4.71	1.869 003	6 00 33
Apr. 1	18 35 24.85 ^{+80.45}	+0 35.95	-18 40 20.4 ^{+28.9}	+0 38.9	4.74	1.857 431	5 57 57

Magnitude: Feb. 16, 7.5; Mar. 7, 7.3; Mar. 27, 7.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	[°] ['] ["]	["]		^h ^m ^s
Apr. 1	18 35 24.85 + 79.36	+0 35.95	-18 40 20.4 + 29.3	+0 38.9	4.74	1.857 431	5 57 57
2	18 36 44.21 + 78.25	35.97	18 39 51.1 + 29.8	0 40.1	4.77	.845 873	5 55 20
3	18 38 02.46 + 77.12	35.98	18 39 21.3 + 30.0	0 41.3	4.80	.834 333	5 52 42
4	18 39 19.58 + 75.98	36.00	18 38 51.3 + 30.1	0 42.4	4.83	.822 810	5 50 02
5	18 40 35.56 + 74.81	36.02	18 38 21.2 + 30.0	0 43.6	4.86	.811 308	5 47 22
6	18 41 50.37 + 73.63	+0 36.04	-18 37 51.2 + 29.7	+0 44.7	4.89	1.799 827	5 44 40
7	18 43 04.00 + 72.44	36.06	18 37 21.5 + 29.4	0 45.8	4.92	.788 370	5 41 57
8	18 44 16.44 + 71.23	36.07	18 36 52.1 + 28.8	0 46.8	4.95	.776 937	5 39 13
9	18 45 27.67 + 70.00	36.08	18 36 23.3 + 28.0	0 47.9	4.99	.765 531	5 36 28
10	18 46 37.67 + 68.74	36.09	18 35 55.3 + 27.2	0 48.9	5.02	.754 152	5 33 41
11*	18 47 46.41 + 67.48	+0 36.10	-18 35 28.1 + 26.1	+0 50.0	5.05	1.742 803	5 30 53
12	18 48 53.89 + 66.19	36.11	18 35 02.0 + 24.9	0 51.0	5.08	.731 485	5 28 04
13	18 50 00.08 + 64.88	36.13	18 34 37.1 + 23.4	0 52.0	5.12	.720 199	5 25 14
14	18 51 04.96 + 63.54	36.14	18 34 13.7 + 21.9	0 53.1	5.15	.708 946	5 22 22
15	18 52 08.50 + 62.19	36.17	18 33 51.8 + 20.2	0 54.1	5.18	.697 729	5 19 30
16	18 53 10.69 + 60.81	+0 36.19	-18 33 31.6 + 18.2	+0 55.1	5.22	1.686 549	5 16 35
17	18 54 11.50 + 59.40	36.21	18 33 13.4 + 16.0	0 56.0	5.25	.675 407	5 13 40
18	18 55 10.90 + 57.97	36.24	18 32 57.4 + 13.8	0 56.9	5.29	.664 306	5 10 42
19	18 56 08.87 + 56.52	36.26	18 32 43.6 + 11.4	0 57.8	5.32	.653 248	5 07 44
20	18 57 05.39 + 55.04	36.28	18 32 32.2 + 8.6	0 58.6	5.36	.642 235	5 04 44
21	18 58 00.43 + 53.53	+0 36.30	-18 32 23.6 + 5.9	+0 59.5	5.40	1.631 269	5 01 43
22	18 58 53.96 + 52.00	36.31	18 32 17.7 + 2.8	1 00.3	5.43	.620 354	4 58 40
23	18 59 45.96 + 50.46	36.33	18 32 14.9 + 0.4	1 01.1	5.47	.609 490	4 55 35
24*	19 00 36.42 + 48.88	36.34	18 32 15.3 + 3.7	1 01.9	5.51	.598 681	4 52 29
25	19 01 25.30 + 47.28	36.36	18 32 19.0 + 7.3	1 02.7	5.54	.587 931	4 49 22
26	19 02 12.58 + 45.66	+0 36.38	-18 32 26.3 + 11.0	+1 03.4	5.58	1.577 240	4 46 12
27	19 02 58.24 + 44.03	36.40	18 32 37.3 + 14.9	1 04.2	5.62	.566 613	4 43 02
28	19 03 42.27 + 42.37	36.42	18 32 52.2 + 19.0	1 04.9	5.66	.556 051	4 39 49
29	19 04 24.64 + 40.69	36.45	18 33 11.2 + 23.2	1 05.6	5.69	.545 558	4 36 35
30	19 05 05.33 + 38.99	36.47	18 33 34.4 + 27.7	1 06.3	5.73	.535 135	4 33 20
May 1	19 05 44.32 + 37.28	+0 36.50	-18 34 02.1 + 32.1	+1 06.9	5.77	1.524 787	4 30 02
2	19 06 21.60 + 35.54	36.53	18 34 34.2 + 37.0	1 07.5	5.81	.514 515	4 26 43
3	19 06 57.14 + 33.79	36.56	18 35 11.2 + 41.8	1 08.1	5.85	.504 323	4 23 22
4	19 07 30.93 + 32.02	36.58	18 35 53.0 + 46.9	1 08.7	5.89	.494 212	4 20 00
5	19 08 02.95 + 30.23	36.61	18 36 39.9 + 52.1	1 09.2	5.93	.484 186	4 16 35
6	19 08 33.18 + 28.42	+0 36.63	-18 37 32.0 + 57.5	+1 09.7	5.97	1.474 247	4 13 09
7	19 09 01.60 + 26.60	36.66	18 38 29.5 + 63.0	1 10.1	6.01	.464 398	4 09 41
8	19 09 28.20 + 24.75	36.68	18 39 32.5 + 68.6	1 10.6	6.05	.454 641	4 06 11
9*	19 09 52.95 + 22.90	36.70	18 40 41.1 + 74.5	1 11.0	6.09	.444 979	4 02 40
10	19 10 15.85 + 21.03	36.73	18 41 55.6 + 80.4	1 11.5	6.13	.435 415	3 59 07
11	19 10 36.88 + 19.12	+0 36.76	-18 43 16.0 + 86.4	+1 11.9	6.17	1.425 951	3 55 31
12	19 10 56.00 + 17.21	36.79	18 44 42.4 + 92.7	1 12.3	6.21	.416 590	3 51 54
13	19 11 13.21 + 15.28	36.83	18 46 15.1 + 99.0	1 12.7	6.25	.407 334	3 48 15
14	19 11 28.49 + 13.32	36.87	18 47 54.1 + 105.4	1 13.0	6.29	.398 187	3 44 34
15	19 11 41.81 + 11.35	36.91	18 49 39.5 + 112.1	1 13.3	6.34	.389 151	3 40 51
16	19 11 53.16 + 9.35	+0 36.95	-18 51 31.6 + 118.7	+1 13.5	6.38	1.380 229	3 37 06
17	19 12 02.51 + 7.35	+0 36.99	-18 53 30.3 + 125.1	+1 13.7	6.42	1.371 426	3 33 19

Magnitude : Apr. 16, 6.8 ; May 6, 6.5

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1960

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
May	17 19 12 02.51 ^{h m s}	^s +0 36.99	-18 53 30.3 ^{° ' "}	+1 13.7	6.42	1.371 426	^{h m s} 3 33 19
	18 19 12 09.86 ⁺	7.35 37.02	18 55 35.7 ^{-125.4}	1 13.9	6.46	.362 744	3 29 30
	19 19 12 15.18	5.32 37.05	18 57 48.1 ^{132.4}	1 14.0	6.50	.354 187	3 25 40
	20 19 12 18.47	3.29 37.09	19 00 07.3 ^{139.2}	1 14.1	6.54	.345 758	3 21 47
	21* 19 12 19.72 ⁺	1.25 37.12	19 02 33.6 ^{146.3}	1 14.2	6.58	.337 462	3 17 52
		0.81	153.3				
	22 19 12 18.91	-2.87 +0 37.15	-19 05 06.9 ^{-160.4}	+1 14.3	6.62	1.329 302	3 13 55
	23 19 12 16.04	4.93 37.19	19 07 47.3 ^{167.6}	1 14.3	6.66	.321 283	3 09 56
	24 19 12 11.11	7.00 37.23	19 10 34.9 ^{174.7}	1 14.4	6.70	.313 407	3 05 55
	25 19 12 04.11	9.05 37.27	19 13 29.6 ^{181.8}	1 14.4	6.74	.305 679	3 01 52
	26 19 11 55.06	11.12 37.31	19 16 31.4 ^{189.0}	1 14.4	6.78	.298 102	2 57 47
	27 19 11 43.94	-13.17 +0 37.36	-19 19 40.4 ^{-196.2}	+1 14.3	6.82	1.290 681	2 53 39
	28 19 11 30.77	15.20 37.40	19 22 56.6 ^{203.2}	1 14.2	6.86	.283 418	2 49 30
	29 19 11 15.57	17.24 37.45	19 26 19.8 ^{210.3}	1 14.1	6.90	.276 318	2 45 19
	30 19 10 58.33	19.25 37.50	19 29 50.1 ^{217.3}	1 13.9	6.93	.269 384	2 41 06
	31 19 10 39.08	21.26 37.54	19 33 27.4 ^{224.3}	1 13.7	6.97	.262 620	2 36 51
June	1 19 10 17.82	-23.23 +0 37.59	-19 37 11.7 ^{-231.1}	+1 13.4	7.01	1.256 029	2 32 33
	2 19 09 54.59	25.19 37.63	19 41 02.8 ^{237.8}	1 13.1	7.04	.249 615	2 28 14
	3 19 09 29.40	27.13 37.67	19 45 00.6 ^{244.4}	1 12.8	7.08	.243 381	2 23 53
	4 19 09 02.27	29.03 37.71	19 49 05.0 ^{251.0}	1 12.5	7.11	.237 330	2 19 30
	5* 19 08 33.24	30.91 37.76	19 53 16.0 ^{257.3}	1 12.1	7.15	.231 465	2 15 05
	6 19 08 02.33	-32.76 +0 37.80	-19 57 33.3 ^{-263.6}	+1 11.7	7.18	1.225 790	2 10 38
	7 19 07 29.57	34.58 37.84	20 01 56.9 ^{269.6}	1 11.4	7.21	.220 307	2 06 10
	8 19 06 54.99	36.36 37.89	20 06 26.5 ^{275.6}	1 11.0	7.24	.215 019	2 01 39
	9 19 06 18.63	38.12 37.95	20 11 02.1 ^{281.2}	1 10.6	7.27	.209 930	1 57 07
	10 19 05 40.51	39.82 38.00	20 15 43.3 ^{286.7}	1 10.1	7.30	.205 041	1 52 33
	11 19 05 00.69	-41.50 +0 38.06	-20 20 30.0 ^{-292.0}	+1 09.6	7.33	1.200 357	1 47 58
	12 19 04 19.19	43.13 38.12	20 25 22.0 ^{297.1}	1 09.0	7.36	.195 880	1 43 21
	13 19 03 36.06	44.71 38.17	20 30 19.1 ^{301.9}	1 08.4	7.39	.191 612	1 38 42
	14 19 02 51.35	46.25 38.22	20 35 21.0 ^{306.6}	1 07.8	7.41	.187 558	1 34 01
	15 19 02 05.10	47.73 38.27	20 40 27.6 ^{310.8}	1 07.1	7.44	.183 720	1 29 19
	16 19 01 17.37	-49.15 +0 38.32	-20 45 38.4 ^{-314.8}	+1 06.4	7.46	1.180 101	1 24 36
	17* 19 00 28.22	50.51 38.36	20 50 53.2 ^{318.6}	1 05.7	7.48	.176 705	1 19 51
	18 18 59 37.71	51.79 38.41	20 56 11.8 ^{322.0}	1 05.0	7.50	.173 534	1 15 05
	19 18 58 45.92	53.02 38.46	21 01 33.8 ^{325.2}	1 04.3	7.52	.170 591	1 10 18
	20 18 57 52.90	54.17 38.50	21 06 59.0 ^{328.0}	1 03.6	7.54	.167 878	1 05 29
	21 18 56 58.73	-55.23 +0 38.55	-21 12 27.0 ^{-330.5}	+1 02.8	7.55	1.165 399	1 00 39
	22 18 56 03.50	56.21 38.61	21 17 57.5 ^{332.7}	1 02.1	7.57	.163 156	0 55 49
	23 18 55 07.29	57.11 38.66	21 23 30.2 ^{334.6}	1 01.3	7.58	.161 150	0 50 57
	24 18 54 10.18	57.93 38.71	21 29 04.8 ^{336.1}	1 00.5	7.59	.159 383	0 46 04
	25 18 53 12.25	58.66 38.77	21 34 40.9 ^{337.4}	0 59.6	7.60	.157 857	0 41 11
	26 18 52 13.59	-59.29 +0 38.82	-21 40 18.3 ^{-338.2}	+0 58.7	7.61	1.156 574	0 36 17
	27 18 51 14.30	59.83 38.87	21 45 56.5 ^{338.7}	0 57.8	7.62	.155 534	0 31 22
	28 18 50 14.47	60.27 38.92	21 51 35.2 ^{339.1}	0 56.9	7.62	.154 739	0 26 26
	29 18 49 14.20	60.63 38.96	21 57 14.3 ^{338.9}	0 56.0	7.63	.154 189	0 21 31
	30 18 48 13.57	60.88 39.00	22 02 53.2 ^{338.6}	0 55.1	7.63	.153 885	0 16 34
July	1 18 47 12.69	-61.05 +0 39.05	-22 08 31.8 ^{-338.0}	+0 54.1	7.63	1.153 827	0 11 38
	2* 18 46 11.64	+0 39.08	-22 14 09.8	+0 53.2	7.63	1.154 016	0 06 42

Magnitude : May 26, 6.2 ; June 15, 6.0

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1960
FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
July	^{h m s} 18 47 12.69	^s - 61.05	^{m s} +0 39.05	^{° ′ ″} -22 08 31.8	[″] +0 54.1	7.63	^{h m s} 1.153 827
	2* 18 46 11.64	61.11	39.08	22 14 09.8	0 53.2	7.63	0 11 38
	3 18 45 10.53	61.08	39.12	22 19 46.7	0 52.3	7.62	0 06 42
	4 18 44 09.45	60.96	39.16	22 25 22.5	0 51.4	7.62	0 01 45
	5 18 43 08.49	60.74	39.21	22 30 56.8	0 50.5	7.61	23 51 52
				332.4			23 46 56
	6 18 42 07.75		+0 39.25	-22 36 29.2	+0 49.6	7.61	1.157 226
	7 18 41 07.31	60.44	39.30	22 41 59.7	0 48.7	7.60	23 42 00
	8 18 40 07.26	60.05	39.35	22 47 28.0	0 47.8	7.59	1.158 640
	9 18 39 07.69	59.57	39.40	22 52 53.8	0 46.8	7.57	23 37 04
	10 18 38 08.68	59.01	39.44	22 58 16.9	0 45.9	7.56	1.160 296
		58.37		320.2			23 32 09
	11 18 37 10.31		+0 39.48	-23 03 37.1	+0 44.9	7.54	1.162 193
	12 18 36 12.67	57.64	39.52	23 08 54.3	0 44.0	7.53	23 22 21
	13 18 35 15.84	56.83	39.55	23 14 08.1	0 43.1	7.51	1.166 709
	14* 18 34 19.91	55.93	39.58	23 19 18.5	0 42.2	7.49	23 17 27
	15 18 33 24.95	54.96	39.61	23 24 25.4	0 41.3	7.47	1.169 326
		53.91		303.0			23 12 35
	16 18 32 31.04		+0 39.63	-23 29 28.4	+0 40.4	7.45	1.172 180
	17 18 31 38.26	52.78	39.66	23 34 27.6	0 39.6	7.42	23 07 44
	18 18 30 46.70	51.56	39.69	23 39 22.7	0 38.8	7.40	1.185 944
	19 18 29 56.43	50.27	39.72	23 44 13.8	0 38.0	7.37	22 48 28
	20 18 29 07.51	48.92	39.75	23 49 00.6	0 37.3	7.34	1.189 964
		47.48		282.5			22 43 42
	21 18 28 20.03		+0 39.79	-23 53 43.1	+0 36.5	7.31	1.194 211
	22 18 27 34.04	45.99	39.82	23 58 21.2	0 35.8	7.28	22 38 58
	23 18 26 49.61	44.43	39.84	24 02 54.9	0 35.0	7.25	1.203 381
	24 18 26 06.80	42.81	39.87	24 07 24.1	0 34.3	7.22	22 29 33
	25 18 25 25.67	41.13	39.89	24 11 48.8	0 33.6	7.19	1.208 297
		39.39		260.1			22 24 53
	26 18 24 46.28		+0 39.91	-24 16 08.9	+0 32.9	7.15	1.213 432
	27 18 24 08.66	37.62	39.93	24 20 24.4	0 32.3	7.12	22 15 37
	28 18 23 32.88	35.78	39.95	24 24 35.4	0 31.7	7.08	1.218 781
	29* 18 22 58.96	33.92	39.96	24 28 41.8	0 31.1	7.05	22 11 02
	30 18 22 26.95	32.01	39.97	24 32 43.6	0 30.5	7.01	1.224 342
		30.07		237.3			22 06 29
Aug.	31 18 21 56.88		+0 39.98	-24 36 40.9	+0 30.0	6.97	1.230 111
	1 18 21 28.78	28.10	40.00	24 40 33.6	0 29.6	6.94	22 01 57
	2 18 21 02.68	26.10	40.01	24 44 21.8	0 29.2	6.90	1.236 086
	3 18 20 38.60	24.08	40.03	24 48 05.5	0 28.8	6.86	21 57 27
	4 18 20 16.55	22.05	40.05	24 51 44.7	0 28.4	6.82	1.242 262
		19.99		214.8			21 52 59
	5 18 19 56.56		+0 40.07	-24 55 19.5	+0 28.0	6.78	1.248 638
	6 18 19 38.61	17.95	40.09	24 58 49.9	0 27.7	6.74	21 48 33
	7 18 19 22.74	15.87	40.11	25 02 15.9	0 27.4	6.70	1.255 207
	8 18 19 08.94	13.80	40.12	25 05 37.6	0 27.1	6.66	21 44 09
	9 18 18 57.22	11.72	40.12	25 08 54.9	0 26.8	6.61	1.261 968
		9.63		193.1			21 39 47
	10* 18 18 47.59		+0 40.13	-25 12 08.0	+0 26.6	6.57	1.268 916
	11 18 18 40.04	7.55	40.13	25 15 16.7	0 26.3	6.53	21 35 27
	12 18 18 34.58	5.46	40.13	25 18 21.2	0 26.2	6.49	1.276 048
	13 18 18 31.21	3.37	40.13	25 21 21.4	0 26.2	6.44	21 31 09
	14 18 18 29.92	1.29	40.14	25 24 17.5	0 26.2	6.40	1.283 360
		0.81		171.8			21 26 53
	15 18 18 30.73		+0 40.14	-25 27 09.3	+0 26.2	6.36	1.290 848
	16 18 18 33.63	2.90	+0 40.15	-25 29 56.9	+0 26.2	6.32	1.298 509

Magnitude : July 5, 6.0 ; July 25, 6.1 ; Aug. 14, 6.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Aug. 16	^{h m s} 18 18 33.63 ^s	^{m s} +0 40.15	^{° ' "} -25 29 56.9	["] +0 26.2	6.32	1.393 258	^{h m s} 20 38 22
17	18 18 38.60 ⁺ 4.97	40.15	25 32 40.4 -163.5	0 26.3	6.27	.402 743	20 34 33
18	18 18 45.66 7.06	40.16	25 35 19.8 159.4	0 26.4	6.23	.412 361	20 30 46
19	18 18 54.78 9.12	40.17	25 37 55.1 155.3	0 26.4	6.19	.422 106	20 27 00
20	18 19 05.95 11.17	40.17	25 40 26.4 151.3	0 26.6	6.15	.431 977	20 23 17
	13.23		147.1				
21	18 19 19.18 ⁺ 15.26	+0 40.17	-25 42 53.5 -143.1	+0 26.7	6.10	1.441 970	20 19 36
22	18 19 34.44 ⁺ 17.29	40.17	25 45 16.6 139.1	0 26.8	6.06	.452 081	20 15 57
23	18 19 51.73 19.29	40.16	25 47 35.7 135.0	0 27.0	6.02	.462 307	20 12 20
24	18 20 11.02 21.28	40.16	25 49 50.7 131.1	0 27.3	5.98	.472 646	20 08 45
25*	18 20 32.30 23.26	40.15	25 52 01.8 127.0	0 27.6	5.93	.483 092	20 05 12
26	18 20 55.56 ⁺ 25.20	+0 40.14	-25 54 08.8 -123.0	+0 27.9	5.89	1.493 644	20 01 41
27	18 21 20.76 ⁺ 27.14	40.13	25 56 11.8 119.1	0 28.3	5.85	.504 297	19 58 12
28	18 21 47.90 29.05	40.13	25 58 10.9 115.1	0 28.7	5.81	.515 049	19 54 44
29	18 22 16.95 30.93	40.12	26 00 06.0 111.1	0 29.1	5.77	.525 896	19 51 19
30	18 22 47.88 32.79	40.12	26 01 57.1 107.2	0 29.6	5.73	.536 835	19 47 55
31	18 23 20.67 ⁺ 34.62	+0 40.12	-26 03 44.3 -103.1	+0 30.1	5.69	1.547 863	19 44 34
Sept. 1	18 23 55.29 ⁺ 36.43	40.12	26 05 27.4 99.2	0 30.6	5.65	.558 977	19 41 14
2	18 24 31.72 38.20	40.12	26 07 06.6 95.1	0 31.1	5.61	.570 174	19 37 55
3	18 25 09.92 39.95	40.12	26 08 41.7 91.0	0 31.6	5.57	.581 451	19 34 39
4	18 25 49.87 41.68	40.11	26 10 12.7 87.1	0 32.2	5.53	.592 807	19 31 24
5	18 26 31.55 ⁺ 43.37	+0 40.10	-26 11 39.8 -82.9	+0 32.7	5.49	1.604 239	19 28 11
6	18 27 14.92 ⁺ 45.04	40.09	26 13 02.7 78.8	0 33.3	5.45	.615 744	19 25 00
7*	18 27 59.96 46.68	40.07	26 14 21.5 74.6	0 34.0	5.41	.627 320	19 21 50
8	18 28 46.64 48.30	40.05	26 15 36.1 70.5	0 34.7	5.37	.638 966	19 18 42
9	18 29 34.94 49.91	40.04	26 16 46.6 66.3	0 35.4	5.33	.650 679	19 15 35
10	18 30 24.85 ⁺ 51.47	+0 40.02	-26 17 52.9 -62.0	+0 36.2	5.29	1.662 457	19 12 30
11	18 31 16.32 ⁺ 53.04	40.01	26 18 54.9 57.7	0 37.0	5.26	.674 298	19 09 27
12	18 32 09.36 54.56	40.00	26 19 52.6 53.4	0 37.8	5.22	.686 199	19 06 25
13	18 33 03.92 56.07	39.99	26 20 46.0 49.0	0 38.6	5.18	.698 160	19 03 24
14	18 33 59.99 57.56	39.98	26 21 35.0 44.7	0 39.5	5.15	.710 177	19 00 25
15	18 34 57.55 ⁺ 59.02	+0 39.97	-26 22 19.7 -40.2	+0 40.3	5.11	1.722 248	18 57 28
16	18 35 56.57 ⁺ 60.46	39.96	26 22 59.9 35.7	0 41.2	5.07	.734 372	18 54 32
17	18 36 57.03 61.88	39.94	26 23 35.6 31.3	0 42.0	5.04	.746 545	18 51 37
18	18 37 58.91 63.27	39.92	26 24 06.9 26.8	0 42.9	5.00	.758 765	18 48 44
19	18 39 02.18 64.65	39.90	26 24 33.7 22.1	0 43.9	4.97	.771 031	18 45 52
20	18 40 06.83 ⁺ 66.00	+0 39.88	-26 24 55.8 -17.6	+0 44.8	4.94	1.783 340	18 43 02
21*	18 41 12.83 ⁺ 67.33	39.86	26 25 13.4 12.9	0 45.8	4.90	.795 690	18 40 12
22	18 42 20.16 68.63	39.83	26 25 26.3 8.2	0 46.7	4.87	.808 077	18 37 24
23	18 43 28.79 69.90	39.81	26 25 34.5 3.5	0 47.8	4.83	.820 501	18 34 38
24	18 44 38.69 71.17	39.78	26 25 38.0 ⁺ 1.2	0 48.8	4.80	.832 959	18 31 52
25	18 45 49.86 ⁺ 72.39	+0 39.76	-26 25 36.8 ⁺ 6.0	+0 49.9	4.77	1.845 448	18 29 08
26	18 47 02.25 ⁺ 73.59	39.74	26 25 30.8 ⁺ 10.8	0 51.0	4.74	.857 966	18 26 25
27	18 48 15.84 74.78	39.72	26 25 20.0 15.7	0 52.1	4.71	.870 511	18 23 44
28	18 49 30.62 75.92	39.71	26 25 04.3 20.5	0 53.3	4.67	.883 080	18 21 03
29	18 50 46.54 77.05	39.69	26 24 43.8 25.5	0 54.4	4.64	.895 673	18 18 23
30	18 52 03.59 ⁺ 78.15	+0 39.67	-26 24 18.3 ⁺ 30.5	+0 55.5	4.61	1.908 288	18 15 45
Oct. 1	18 53 21.74 ⁺	+0 39.65	-26 23 47.8 ⁺	+0 56.6	4.58	1.920 921	18 13 08

Magnitude: Sept. 3, 6.7; Sept. 23, 7.0

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1960

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	[°] ['] ["]			^h ^m ^s
Oct. 1	18 53 21.74 ⁺	+0 39.65	-26 23 47.8 ⁺	+0 56.6	4.58	1.920 921	18 13 08
2	18 54 40.96 ⁺	39.62	26 23 12.4 ⁺	0 57.8	4.55	.933 573	18 10 31
3	18 56 01.24	39.59	26 22 31.9	0 58.9	4.52	.946 241	18 07 56
4	18 57 22.54	39.56	26 21 46.3	1 00.1	4.49	.958 924	18 05 22
5*	18 58 44.84	39.52	26 20 55.6	1 01.3	4.46	.971 622	18 02 49
6	19 00 08.13 ⁺	+0 39.49	-26 19 59.7 ⁺	+1 02.5	4.44	1.984 331	18 00 16
7	19 01 32.39	39.46	26 18 58.6 ⁺	1 03.8	4.41	1.997 052	17 57 45
8	19 02 57.59	39.43	26 17 52.3	1 05.0	4.38	2.009 783	17 55 15
9	19 04 23.71	39.40	26 16 40.6	1 06.3	4.35	.022 523	17 52 45
10	19 05 50.74	39.37	26 15 23.6	1 07.6	4.32	.035 269	17 50 17
11	19 07 18.67 ⁺	+0 39.34	-26 14 01.3 ⁺	+1 08.9	4.30	2.048 022	17 47 49
12	19 08 47.46 ⁺	39.31	26 12 33.5 ⁺	1 10.2	4.27	.060 779	17 45 22
13	19 10 17.11	39.28	26 11 00.3	1 11.5	4.24	.073 539	17 42 56
14	19 11 47.60	39.25	26 09 21.7	1 12.8	4.22	.086 301	17 40 31
15	19 13 18.90	39.22	26 07 37.5	1 14.1	4.19	.099 062	17 38 06
16	19 14 51.01 ⁺	+0 39.18	-26 05 47.8 ⁺	+1 15.4	4.17	2.111 821	17 35 42
17	19 16 23.91 ⁺	39.14	26 03 52.5 ⁺	1 16.7	4.14	.124 577	17 33 20
18	19 17 57.57	39.10	26 01 51.7	1 18.0	4.12	.137 328	17 30 57
19	19 19 31.99	39.05	25 59 45.2	1 19.3	4.09	.150 073	17 28 36
20*	19 21 07.14	39.01	25 57 33.1	1 20.7	4.07	.162 809	17 26 15
21	19 22 43.01 ⁺	+0 38.97	-25 55 15.4 ⁺	+1 22.1	4.05	2.175 535	17 23 55
22	19 24 19.59 ⁺	38.93	25 52 51.9	1 23.4	4.02	.188 249	17 21 36
23	19 25 56.84	38.89	25 50 22.8	1 24.9	4.00	.200 950	17 19 17
24	19 27 34.76	38.85	25 47 48.0	1 26.3	3.98	.213 635	17 16 59
25	19 29 13.32	38.82	25 45 07.5	1 27.7	3.95	.226 303	17 14 42
26	19 30 52.51 ⁺	+0 38.78	-25 42 21.2 ⁺	+1 29.1	3.93	2.238 952	17 12 25
27	19 32 32.31 ⁺	38.75	25 39 29.3 ⁺	1 30.5	3.91	.251 582	17 10 09
28	19 34 12.69	38.71	25 36 31.5	1 31.8	3.89	.264 191	17 07 54
29	19 35 53.65	38.66	25 33 28.0	1 33.2	3.87	.276 777	17 05 38
30	19 37 35.16	38.62	25 30 18.7	1 34.6	3.84	.289 340	17 03 24
31	19 39 17.20 ⁺	+0 38.57	-25 27 03.6 ⁺	+1 35.9	3.82	2.301 879	17 01 10
Nov. 1	19 40 59.76 ⁺	38.52	25 23 42.8 ⁺	1 37.3	3.80	.314 392	16 58 57
2*	19 42 42.83	38.47	25 20 16.1	1 38.7	3.78	.326 878	16 56 44
3	19 44 26.39	38.42	25 16 43.6	1 40.2	3.76	.339 338	16 54 31
4	19 46 10.42	38.37	25 13 05.2	1 41.6	3.74	.351 770	16 52 19
5	19 47 54.91 ⁺	+0 38.32	-25 09 21.1 ⁺	+1 43.0	3.72	2.364 173	16 50 07
6	19 49 39.85	38.28	25 05 31.0	1 44.5	3.70	.376 546	16 47 56
7	19 51 25.23	38.23	25 01 35.2	1 45.9	3.68	.388 887	16 45 46
8	19 53 11.04	38.19	24 57 33.4	1 47.3	3.67	.401 198	16 43 35
9	19 54 57.26	38.14	24 53 25.8	1 48.7	3.65	.413 475	16 41 25
10	19 56 43.88	+0 38.09	-24 49 12.3 ⁺	+1 50.1	3.63	2.425 718	16 39 16
11	19 58 30.89	38.05	24 44 53.0	1 51.5	3.61	.437 926	16 37 07
12	20 00 18.28	37.99	24 40 27.8	1 52.9	3.59	.450 097	16 34 58
13	20 02 06.04	37.94	24 35 56.8	1 54.3	3.57	.462 231	16 32 49
14	20 03 54.16	37.88	24 31 19.9	1 55.6	3.56	.474 326	16 30 41
15	20 05 42.63 ⁺	+0 37.83	-24 26 37.1 ⁺	+1 57.0	3.54	2.486 380	16 28 34
16	20 07 31.43	+0 37.77	-24 21 48.6 ⁺	+1 58.4	3.52	2.498 394	16 26 26

Magnitude : Oct. 13, 7.3 ; Nov. 2, 7.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. - Astr.	Astrometric 1950.0	App. - Astr.			
Nov. 16	^{h m s} 20 07 31.43 ^s	^{m s} +0 37.77	^{° ' "} -24 21 48.6	["] +1 58.4	3.52	2.498 394	^{h m s} 16 26 26
17*	20 09 20.55 ^{+109.12}	37.71	24 16 54.1 ^{+294.5}	1 59.8	3.51	.510 364	16 24 19
18	20 11 09.99 ^{109.44}	37.66	24 11 53.9 ^{300.2}	2 01.2	3.49	.522 290	16 22 12
19	20 12 59.74 ^{109.75}	37.60	24 06 48.0 ^{305.9}	2 02.6	3.47	.534 170	16 20 06
20	20 14 49.77 ^{110.03}	37.55	24 01 36.2 ^{311.8}	2 04.0	3.46	.546 003	16 18 00
21	20 16 40.08 ^{110.31}	+0 37.51	-23 56 18.7 ^{317.5}	+2 05.4	3.44	2.557 786	16 15 54
22	20 18 30.66 ^{+110.58}	37.46	23 50 55.4 ^{+323.3}	2 06.8	3.43	.569 521	16 13 48
23	20 20 21.50 ^{110.84}	37.41	23 45 26.5 ^{328.9}	2 08.2	3.41	.581 203	16 11 43
24	20 22 12.57 ^{111.07}	37.36	23 39 51.9 ^{334.6}	2 09.6	3.39	.592 833	16 09 38
25	20 24 03.87 ^{111.30}	37.31	23 34 11.6 ^{340.3}	2 10.9	3.38	.604 410	16 07 33
26	20 25 55.39 ^{111.52}	+0 37.25	-23 28 25.7 ^{345.9}	+2 12.2	3.37	2.615 932	16 05 28
27	20 27 47.11 ^{+111.72}	37.19	23 22 34.2 ^{+351.5}	2 13.5	3.35	.627 399	16 03 23
28	20 29 39.03 ^{111.92}	37.13	23 16 37.2 ^{357.0}	2 14.8	3.34	.638 810	16 01 19
29	20 31 31.13 ^{112.10}	37.07	23 10 34.6 ^{362.6}	2 16.1	3.32	.650 164	15 59 15
30*	20 33 23.40 ^{112.27}	37.01	23 04 26.5 ^{368.1}	2 17.5	3.31	.661 461	15 57 11
Dec. 1	20 35 15.84 ^{112.44}	+0 36.95	-22 58 12.8 ^{373.7}	+2 18.8	3.29	2.672 700	15 55 07
2	20 37 08.43 ^{+112.59}	36.90	22 51 53.8 ^{+379.0}	2 20.1	3.28	.683 881	15 53 03
3	20 39 01.16 ^{112.73}	36.84	22 45 29.3 ^{384.5}	2 21.5	3.27	.695 002	15 50 59
4	20 40 54.04 ^{112.88}	36.79	22 38 59.3 ^{390.0}	2 22.8	3.25	.706 063	15 48 56
5	20 42 47.05 ^{113.01}	36.73	22 32 24.0 ^{395.3}	2 24.1	3.24	.717 063	15 46 52
6	20 44 40.19 ^{113.14}	+0 36.68	-22 25 43.3 ^{400.7}	+2 25.4	3.23	2.728 001	15 44 49
7	20 46 33.45 ^{+113.26}	36.63	22 18 57.3 ^{+406.0}	2 26.6	3.21	.738 878	15 42 46
8	20 48 26.82 ^{113.37}	36.57	22 12 06.0 ^{411.3}	2 27.9	3.20	.749 691	15 40 43
9	20 50 20.29 ^{113.47}	36.52	22 05 09.5 ^{416.5}	2 29.1	3.19	.760 440	15 38 40
10	20 52 13.86 ^{113.57}	36.46	21 58 07.7 ^{421.8}	2 30.3	3.18	.771 124	15 36 37
11	20 54 07.53 ^{113.67}	+0 36.40	-21 51 00.7 ^{427.0}	+2 31.5	3.16	2.781 742	15 34 35
12	20 56 01.29 ^{+113.76}	36.34	21 43 48.6 ^{+432.1}	2 32.7	3.15	.792 293	15 32 32
13	20 57 55.13 ^{113.84}	36.27	21 36 31.4 ^{437.2}	2 33.9	3.14	.802 776	15 30 30
14	20 59 49.04 ^{113.91}	36.21	21 29 09.1 ^{442.3}	2 35.1	3.13	.813 189	15 28 27
15*	21 01 43.03 ^{113.99}	36.15	21 21 41.7 ^{447.4}	2 36.3	3.12	.823 533	15 26 25
16	21 03 37.08 ^{114.05}	+0 36.09	-21 14 09.4 ^{452.3}	+2 37.5	3.11	2.833 805	15 24 22
17	21 05 31.19 ^{+114.11}	36.04	21 06 32.1 ^{+457.3}	2 38.7	3.10	.844 004	15 22 20
18	21 07 25.36 ^{114.17}	35.99	20 58 49.9 ^{462.2}	2 39.9	3.08	.854 130	15 20 18
19	21 09 19.56 ^{114.20}	35.94	20 51 02.9 ^{467.0}	2 41.1	3.07	.864 180	15 18 16
20	21 11 13.81 ^{114.25}	35.89	20 43 11.0 ^{471.9}	2 42.3	3.06	.874 153	15 16 13
21	21 13 08.08 ^{114.27}	+0 35.84	-20 35 14.4 ^{476.6}	+2 43.4	3.05	2.884 049	15 14 11
22	21 15 02.38 ^{+114.30}	35.79	20 27 13.2 ^{+481.2}	2 44.5	3.04	.893 867	15 12 09
23	21 16 56.69 ^{114.31}	35.73	20 19 07.3 ^{485.9}	2 45.6	3.03	.903 606	15 10 07
24	21 18 51.01 ^{114.32}	35.68	20 10 56.9 ^{490.4}	2 46.7	3.02	.913 265	15 08 05
25	21 20 45.33 ^{114.32}	35.62	20 02 41.9 ^{495.0}	2 47.7	3.01	.922 843	15 06 03
26	21 22 39.64 ^{114.31}	+0 35.56	-19 54 22.4 ^{499.5}	+2 48.8	3.00	2.932 341	15 04 01
27	21 24 33.94 ^{+114.30}	35.50	19 45 58.6 ^{+503.8}	2 49.9	2.99	.941 757	15 01 58
28*	21 26 28.22 ^{114.28}	35.44	19 37 30.4 ^{508.2}	2 50.9	2.98	.951 091	14 59 56
29	21 28 22.49 ^{114.27}	35.38	19 28 57.8 ^{512.6}	2 52.0	2.97	.960 342	14 57 54
30	21 30 16.72 ^{114.23}	35.33	19 20 21.0 ^{516.8}	2 53.0	2.96	.969 511	14 55 52
31	21 32 10.93 ^{114.21}	+0 35.28	-19 11 40.0 ^{521.0}	+2 54.1	2.96	2.978 597	14 53 50
32	21 34 05.10 ^{+114.17}	+0 35.23	-19 02 54.8 ^{+525.2}	+2 55.1	2.95	2.987 599	14 51 47

Magnitude: Nov. 22, 7.8; Dec. 12, 8.0; Dec. 32, 8.2

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

Date	A	B	C	D	E	$d\psi$	$d\epsilon$	τ	S.T.
						(0 ^{''} .001)			
Jan. 0	- 0.003	+9.899	- 2.797	+20.261	0.0000	+175	- 51	-0.0037	6.6
1	+ 0.085	9.858	3.129	20.202	0	+227	- 16	- .0009	6.6
2	0.153	9.813	3.459	20.137	0	+231	+ 21	+ .0018	6.7
3	0.204	9.777	3.788	20.065	0	+192	+ 50	.0045	6.8
4	0.244	9.751	4.115	19.986	0	+125	+ 67	.0073	6.8
5	+ 0.279	+9.739	- 4.440	+19.902	0.0000	+ 48	+ 70	+0.0100	6.9
6	0.316	9.740	4.764	19.811	0	- 24	+ 59	.0127	7.0
7	0.358	9.751	5.086	19.714	0	- 81	+ 38	.0155	7.0
8	0.410	9.767	5.406	19.611	0	-114	+ 11	.0182	7.1
9	0.472	9.783	5.723	19.501	0	-121	- 17	.0210	7.2
10	+ 0.543	+9.796	- 6.039	+19.387	0.0000	-103	- 42	+0.0237	7.2
11	0.623	9.800	6.353	19.266	0	- 63	- 59	.0264	7.3
12	0.707	9.793	6.665	19.140	0	- 11	- 66	.0292	7.4
13	0.791	9.776	6.974	19.008	+ 1	+ 43	- 63	.0319	7.4
14	0.872	9.746	7.281	18.870	1	+ 89	- 47	.0347	7.5
15	+ 0.945	+9.708	- 7.586	+18.726	+0.0001	+117	- 24	+0.0374	7.6
16	1.008	9.663	7.889	18.578	1	+120	+ 5	.0401	7.6
17	1.058	9.617	8.190	18.423	1	+ 93	+ 35	.0429	7.7
18	1.097	9.578	8.488	18.263	1	+ 39	+ 58	.0456	7.8
19	1.129	9.549	8.784	18.098	1	- 32	+ 70	.0483	7.8
20	+ 1.158	+9.534	- 9.078	+17.926	+0.0001	-109	+ 68	+0.0511	7.9
21	1.190	9.533	9.369	17.750	0	-176	+ 51	.0538	8.0
22	1.233	9.544	9.657	17.567	0	-215	+ 22	.0566	8.0
23	1.290	9.562	9.943	17.379	0	-216	- 14	.0593	8.1
24	1.365	9.577	10.226	17.184	0	-170	- 48	.0620	8.2
25	+ 1.455	+9.581	-10.506	+16.984	+0.0001	- 86	- 71	+0.0648	8.2
26	1.553	9.567	10.783	16.779	1	+ 20	- 76	.0675	8.3
27	1.648	9.533	11.056	16.567	1	+121	- 62	.0702	8.4
28	1.731	9.484	11.325	16.350	1	+192	- 32	.0730	8.4
29	1.796	9.427	11.591	16.127	1	+220	+ 5	.0757	8.5
30	+ 1.842	+9.373	-11.852	+15.899	+0.0001	+201	+ 39	+0.0785	8.5
31	1.873	9.330	12.109	15.666	1	+146	+ 62	.0812	8.6
Feb. 1	1.895	9.300	12.362	15.428	1	+ 72	+ 71	.0839	8.7
2	1.916	9.286	12.610	15.185	1	- 4	+ 65	.0867	8.7
3	1.942	9.283	12.854	14.937	+ 1	- 67	+ 47	.0894	8.8
4	+ 1.976	+9.289	-13.094	+14.685	0.0000	-107	+ 21	+0.0921	8.9
5	2.020	9.296	13.329	14.429	0	-121	- 7	.0949	8.9
6	2.073	9.302	13.560	14.169	0	-109	- 33	.0976	9.0
7	2.135	9.302	13.786	13.905	0	- 75	- 54	.1004	9.1
8	2.202	9.293	14.008	13.636	+ 1	- 25	- 65	.1031	9.1
9	+ 2.271	+9.272	-14.225	+13.365	+0.0001	+ 30	- 65	+0.1058	9.2
10	2.337	9.240	14.438	13.089	1	+ 80	- 53	.1086	9.3
11	2.396	9.199	14.646	12.809	1	+115	- 32	.1113	9.3
12	2.446	9.151	14.850	12.527	1	+128	- 4	.1141	9.4
13	2.483	9.101	15.049	12.240	+ 1	+111	+ 26	.1168	9.5
14	+ 2.509	+9.055	-15.244	+11.951	0.0000	+ 66	+ 52	+0.1195	9.5
15	+ 2.525	+9.020	-15.434	+11.657	0.0000	- 1	+ 68	+0.1223	9.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Jan. 0	-0.0004	9.899	6 00 04	20.453	23 28 34	-1.213	+107	86	2 25
1	+0.0131	9.858	5 58 01	20.443	23 24 47	1.357	+139	92	0 40
2	.0236	9.814	5 56 26	20.432	23 21 01	1.500	+141	94	23 09
3	.0314	9.779	5 55 13	20.419	23 17 14	1.643	+117	91	21 47
4	.0374	9.754	5 54 16	20.405	23 13 28	1.785	+ 76	83	20 26
5	+0.0428	9.743	5 53 26	20.391	23 09 42	-1.925	+ 29	73	19 01
6	.0485	9.745	5 52 34	20.376	23 05 55	2.066	- 15	60	17 23
7	.0550	9.758	5 51 35	20.359	23 02 08	2.206	- 50	50	15 19
8	.0629	9.776	5 50 23	20.343	22 58 21	2.344	- 70	47	12 55
9	.0724	9.794	5 48 57	20.324	22 54 35	2.482	- 74	51	10 42
10	+0.0834	9.811	5 47 19	20.306	22 50 48	-2.619	- 63	59	8 57
11	.0956	9.820	5 45 27	20.286	22 47 00	2.755	- 39	64	7 32
12	.1085	9.818	5 43 29	20.267	22 43 12	2.890	- 7	66	6 15
13	.1214	9.808	5 41 30	20.247	22 39 25	3.024	+ 26	65	4 59
14	.1338	9.785	5 39 33	20.226	22 35 36	3.157	+ 54	59	3 32
15	+0.1451	9.754	5 37 46	20.204	22 31 47	-3.290	+ 72	52	1 49
16	.1547	9.715	5 36 11	20.184	22 27 58	3.421	+ 73	48	23 36
17	.1624	9.675	5 34 53	20.162	22 24 08	3.552	+ 57	51	21 06
18	.1683	9.641	5 33 52	20.139	22 20 18	3.681	+ 24	60	19 00
19	.1732	9.616	5 33 02	20.117	22 16 27	3.809	- 20	71	17 19
20	+0.1776	9.604	5 32 18	20.094	22 12 34	-3.937	- 67	81	15 50
21	.1825	9.607	5 31 32	20.071	22 08 42	4.063	-108	87	14 24
22	.1891	9.623	5 30 33	20.046	22 04 48	4.188	-132	88	12 58
23	.1979	9.649	5 29 16	20.022	22 00 54	4.312	-132	87	11 23
24	.2094	9.674	5 27 33	19.997	21 56 59	4.435	-104	83	9 38
25	+0.2232	9.691	5 25 28	19.971	21 53 03	-4.556	- 53	79	7 43
26	.2382	9.692	5 23 07	19.945	21 49 06	4.676	+ 12	76	5 36
27	.2529	9.674	5 20 46	19.917	21 45 08	4.795	+ 74	78	3 29
28	.2656	9.641	5 18 37	19.889	21 41 10	4.911	+117	83	1 31
29	.2756	9.596	5 16 51	19.860	21 37 11	5.027	+135	88	23 47
30	+0.2826	9.552	5 15 32	19.831	21 33 11	-5.140	+123	89	22 16
31	.2873	9.516	5 14 36	19.800	21 29 12	5.251	+ 89	85	20 53
Feb. 1	.2907	9.491	5 13 56	19.770	21 25 11	5.361	+ 44	77	19 28
2	.2940	9.482	5 13 22	19.738	21 21 10	5.468	- 2	65	17 54
3	.2978	9.484	5 12 44	19.706	21 17 09	5.574	- 41	54	16 02
4	+0.3031	9.497	5 11 58	19.675	21 13 07	-5.678	- 65	47	13 45
5	.3098	9.513	5 10 58	19.643	21 09 05	5.780	- 74	49	11 27
6	.3180	9.530	5 09 45	19.612	21 05 02	5.880	- 67	55	9 31
7	.3274	9.544	5 08 18	19.581	21 00 59	5.978	- 46	62	7 56
8	.3377	9.550	5 06 41	19.549	20 56 55	6.075	- 15	66	6 35
9	+0.3483	9.546	5 04 57	19.519	20 52 51	-6.169	+ 18	66	5 18
10	.3584	9.531	5 03 14	19.488	20 48 46	6.261	+ 49	62	3 56
11	.3675	9.506	5 01 36	19.457	20 44 41	6.351	+ 70	56	2 20
12	.3751	9.472	5 00 09	19.428	20 40 36	6.440	+ 78	51	0 18
13	.3808	9.434	4 58 58	19.398	20 36 29	6.526	+ 68	51	21 58
14	+0.3848	9.396	4 58 03	19.370	20 32 23	-6.611	+ 40	58	19 47
15	+0.3873	9.367	4 57 27	19.342	20 28 15	-6.693	- 1	68	17 59

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	$d\psi$	$d\epsilon$	τ	S.T.
						(0".001)			
Feb. 15	+ 2.525	+9.020	-15.434	+11.657	0.0000	- 1	+ 68	+0.1223	9.6
16	2.537	8.999	15.620	11.361	0	- 78	+ 70	.1250	9.7
17	2.551	8.993	15.802	11.061	0	-147	+ 57	.1277	9.7
18	2.573	9.000	15.979	10.757	0	-194	+ 31	.1305	9.8
19	2.609	9.017	16.151	10.450	0	-206	- 4	.1332	9.9
20	+ 2.661	+9.032	-16.319	+10.140	0.0000	-176	- 37	+0.1360	9.9
21	2.727	9.041	16.481	9.826	0	-108	- 63	.1387	10.0
22	2.803	9.034	16.639	9.509	0	- 15	- 74	.1414	10.1
23	2.880	9.011	16.791	9.189	0	+ 82	- 67	.1442	10.1
24	2.949	8.971	16.938	8.865	0	+160	- 44	.1469	10.2
25	+ 3.003	+8.922	-17.080	+ 8.538	0.0000	+203	- 10	+0.1496	10.3
26	3.039	8.870	17.216	8.209	0	+201	+ 26	.1524	10.3
27	3.059	8.827	17.346	7.877	0	+160	+ 54	.1551	10.4
28	3.068	8.798	17.470	7.542	0	+ 92	+ 69	.1579	10.5
29	3.072	8.784	17.589	7.205	- 1	+ 15	+ 69	.1606	10.5
Mar. 1	+ 3.080	+8.784	-17.701	+ 6.867	-0.0001	- 54	+ 55	+0.1633	10.6
2	3.095	8.795	17.808	6.526	1	-103	+ 31	.1661	10.7
3	3.120	8.811	17.909	6.184	1	-126	+ 3	.1688	10.7
4	3.156	8.827	18.004	5.841	1	-121	- 25	.1715	10.8
5	3.201	8.839	18.093	5.496	1	- 92	- 48	.1743	10.8
6	+ 3.252	+8.842	-18.177	+ 5.150	-0.0001	- 47	- 62	+0.1770	10.9
7	3.307	8.836	18.255	4.803	1	+ 8	- 66	.1798	11.0
8	3.360	8.819	18.327	4.456	1	+ 61	- 58	.1825	11.0
9	3.409	8.792	18.394	4.107	1	+103	- 40	.1852	11.1
10	3.450	8.758	18.456	3.758	1	+124	- 14	.1880	11.2
11	+ 3.479	+8.721	-18.511	+ 3.408	-0.0001	+118	+ 16	+0.1907	11.2
12	3.497	8.686	18.562	3.057	1	+ 83	+ 44	.1935	11.3
13	3.505	8.660	18.608	2.706	2	+ 24	+ 64	.1962	11.4
14	3.506	8.647	18.648	2.355	2	- 51	+ 71	.1989	11.4
15	3.508	8.650	18.683	2.003	2	-124	+ 63	.2017	11.5
16	+ 3.518	+8.670	-18.712	+ 1.650	-0.0002	-178	+ 39	+0.2044	11.6
17	3.541	8.699	18.737	1.297	2	-198	+ 6	.2071	11.6
18	3.580	8.731	18.756	0.944	2	-176	- 29	.2099	11.7
19	3.636	8.757	18.770	0.589	2	-114	- 57	.2126	11.8
20	3.701	8.771	18.778	+ 0.235	2	- 28	- 72	.2154	11.8
21	+ 3.769	+8.768	-18.780	- 0.120	-0.0002	+ 66	- 70	+0.2181	11.9
22	3.831	8.748	18.777	0.475	2	+146	- 51	.2208	12.0
23	3.882	8.718	18.768	0.830	2	+195	- 20	.2236	12.0
24	3.916	8.684	18.753	1.186	2	+204	+ 15	.2263	12.1
25	3.935	8.655	18.732	1.540	2	+174	+ 46	.2290	12.2
26	+ 3.942	+8.638	-18.706	- 1.895	-0.0003	+113	+ 65	+0.2318	12.2
27	3.943	8.636	18.673	2.248	3	+ 37	+ 70	.2345	12.3
28	3.945	8.648	18.634	2.601	3	- 36	+ 62	.2373	12.4
29	3.953	8.673	18.589	2.953	3	- 94	+ 41	.2400	12.4
30	3.971	8.706	18.539	3.303	3	-127	+ 13	.2427	12.5
31	+ 4.002	+8.740	-18.482	- 3.652	-0.0003	-131	- 15	+0.2455	12.6
Apr. 1	+ 4.042	+8.772	-18.420	- 3.999	-0.0004	-110	- 41	+0.2482	12.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Feb. 15	+0.3873	9.367	4 57 27	19.342	20 28 15	-6.693	- 1	68	17 59
16	.3890	9.350	4 57 02	19.315	20 24 07	6.774	- 48	77	16 24
17	.3912	9.348	4 56 39	19.288	20 19 58	6.853	- 90	82	14 57
18	.3946	9.361	4 56 11	19.263	20 15 47	6.929	-119	83	13 28
19	.4001	9.387	4 55 27	19.237	20 11 37	7.004	-126	82	11 49
20	+0.4080	9.416	4 54 20	19.213	20 07 25	-7.077	-108	79	10 09
21	.4182	9.443	4 52 52	19.188	20 03 13	7.147	- 66	76	8 17
22	.4298	9.459	4 51 03	19.164	19 58 59	7.216	- 9	74	6 19
23	.4416	9.460	4 49 06	19.141	19 54 46	7.282	+ 50	75	4 16
24	.4522	9.443	4 47 13	19.118	19 50 30	7.345	+ 98	77	2 19
25	+0.4605	9.414	4 45 36	19.095	19 46 14	-7.407	+124	81	0 28
26	.4660	9.376	4 44 21	19.073	19 41 58	7.466	+123	84	22 48
27	.4691	9.342	4 43 33	19.051	19 37 41	7.522	+ 98	83	21 19
28	.4704	9.318	4 43 06	19.028	19 33 24	7.576	+ 56	78	19 52
29	.4711	9.306	4 42 54	19.007	19 29 06	7.628	+ 9	69	18 20
Mar. 1	+0.4723	9.308	4 42 43	18.986	19 24 49	-7.676	- 33	59	16 35
2	.4746	9.324	4 42 27	18.966	19 20 30	7.723	- 63	51	14 28
3	.4784	9.347	4 42 00	18.947	19 16 12	7.766	- 77	50	12 14
4	.4839	9.374	4 41 18	18.928	19 11 54	7.808	- 74	54	10 10
5	.4908	9.401	4 40 22	18.909	19 07 35	7.846	- 56	60	8 29
6	+0.4986	9.421	4 39 14	18.893	19 03 16	-7.883	- 29	65	7 07
7	.5070	9.435	4 37 56	18.876	18 58 58	7.916	+ 5	66	5 49
8	.5152	9.437	4 36 34	18.861	18 54 40	7.948	+ 37	63	4 29
9	.5227	9.430	4 35 14	18.847	18 50 21	7.977	+ 63	57	2 57
10	.5289	9.413	4 34 00	18.835	18 46 02	8.004	+ 76	51	1 03
11	+0.5334	9.389	4 33 01	18.822	18 41 44	-8.027	+ 72	50	22 45
12	.5361	9.364	4 32 17	18.812	18 37 24	8.050	+ 51	55	20 27
13	.5373	9.342	4 31 52	18.804	18 33 06	8.070	+ 15	65	18 34
14	.5375	9.331	4 31 43	18.796	18 28 47	8.087	- 31	74	16 56
15	.5378	9.334	4 31 42	18.790	18 24 29	8.102	- 76	80	15 28
16	+0.5393	9.357	4 31 40	18.785	18 20 10	-8.115	-109	81	13 55
17	.5427	9.392	4 31 24	18.782	18 15 50	8.126	-121	79	12 17
18	.5488	9.436	4 30 49	18.780	18 11 31	8.134	-108	76	10 30
19	.5573	9.482	4 29 49	18.779	18 07 11	8.140	- 70	73	8 34
20	.5673	9.520	4 28 29	18.780	18 02 52	8.143	- 17	73	6 35
21	+0.5777	9.544	4 26 57	18.781	17 58 32	-8.144	+ 40	75	4 38
22	.5873	9.550	4 25 24	18.783	17 54 12	8.143	+ 89	77	2 45
23	.5951	9.543	4 23 59	18.786	17 49 52	8.139	+119	80	0 58
24	.6003	9.526	4 22 55	18.791	17 45 32	8.132	+125	83	23 18
25	.6032	9.508	4 22 12	18.795	17 41 12	8.123	+106	83	21 46
26	+0.6042	9.495	4 21 53	18.802	17 36 52	-8.112	+ 69	79	20 19
27	.6043	9.494	4 21 50	18.808	17 32 32	8.098	+ 23	71	18 47
28	.6047	9.505	4 21 55	18.815	17 28 13	8.081	- 22	64	17 08
29	.6059	9.531	4 22 00	18.822	17 23 54	8.061	- 57	55	15 11
30	.6087	9.569	4 21 56	18.831	17 19 35	8.040	- 78	52	12 58
31	+0.6133	9.613	4 21 36	18.839	17 15 17	-8.015	- 80	54	10 56
Apr. 1	+0.6195	9.658	4 21 03	18.849	17 11 00	-7.988	- 67	60	9 08

Date	A	B	C	D	E	$d\psi$	$d\epsilon$	τ	S.T.
						(0 ^{''} .001)			^h
Apr. 1	+ 4.042	+8.772	-18.420	- 3.999	-0.0004	-110	- 41	+0.2482	12.6
2	4.091	8.795	18.353	4.345	4	- 68	- 58	.2509	12.7
3	4.144	8.811	18.280	4.688	4	- 15	- 66	.2537	12.8
4	4.199	8.815	18.201	5.030	4	+ 39	- 62	.2564	12.8
5	4.250	8.808	18.118	5.370	4	+ 84	- 47	.2592	12.9
6	+ 4.294	+8.794	-18.029	- 5.707	-0.0004	+112	- 24	+0.2619	13.0
7	4.329	8.774	17.935	6.043	4	+116	+ 6	.2646	13.0
8	4.354	8.755	17.836	6.376	4	+ 92	+ 35	.2674	13.1
9	4.367	8.743	17.733	6.706	4	+ 40	+ 58	.2701	13.1
10	4.374	8.741	17.624	7.035	4	- 31	+ 71	.2728	13.2
11	+ 4.379	+8.755	-17.511	- 7.361	-0.0004	-107	+ 68	+0.2756	13.3
12	4.390	8.786	17.393	7.685	4	-170	+ 49	.2783	13.3
13	4.413	8.830	17.271	8.006	5	-201	+ 18	.2811	13.4
14	4.454	8.881	17.144	8.326	5	-189	- 20	.2838	13.5
15	4.513	8.926	17.013	8.643	5	-133	- 52	.2865	13.5
16	+ 4.586	+8.959	-16.876	- 8.958	-0.0005	- 45	- 71	+0.2893	13.6
17	4.663	8.975	16.735	9.270	4	+ 54	- 73	.2920	13.7
18	4.736	8.973	16.590	9.581	4	+141	- 57	.2948	13.7
19	4.797	8.959	16.439	9.888	4	+199	- 28	.2975	13.8
20	4.843	8.940	16.283	10.194	4	+216	+ 6	.3002	13.9
21	+ 4.874	+8.924	-16.122	-10.496	-0.0005	+193	+ 38	+0.3030	13.9
22	4.892	8.916	15.956	10.795	5	+138	+ 61	.3057	14.0
23	4.904	8.923	15.786	11.091	5	+ 65	+ 70	.3084	14.1
24	4.914	8.944	15.610	11.384	5	- 12	+ 66	.3112	14.1
25	4.931	8.978	15.430	11.673	5	- 77	+ 48	.3139	14.2
26	+ 4.957	+9.021	-15.245	-11.958	-0.0005	-118	+ 22	+0.3167	14.3
27	4.993	9.067	15.055	12.240	5	-133	- 7	.3194	14.3
28	5.042	9.111	14.861	12.518	5	-120	- 34	.3221	14.4
29	5.100	9.148	14.662	12.791	5	- 85	- 54	.3249	14.5
30	5.165	9.176	14.460	13.060	5	- 35	- 65	.3276	14.5
May 1	+ 5.232	+9.193	-14.253	-13.325	-0.0005	+ 20	- 65	+0.3303	14.6
2	5.296	9.199	14.043	13.586	5	+ 68	- 53	.3331	14.7
3	5.357	9.195	13.828	13.842	5	+102	- 32	.3358	14.7
4	5.407	9.186	13.610	14.094	5	+112	- 5	.3386	14.8
5	5.448	9.174	13.388	14.342	5	+ 96	+ 24	.3413	14.9
6	+ 5.479	+9.166	-13.163	-14.585	-0.0005	+ 53	+ 50	+0.3440	14.9
7	5.502	9.166	12.934	14.823	5	- 12	+ 67	.3468	15.0
8	5.521	9.180	12.703	15.057	6	- 88	+ 71	.3495	15.1
9	5.542	9.209	12.468	15.287	6	-160	+ 59	.3522	15.1
10	5.574	9.254	12.230	15.512	6	-207	+ 31	.3550	15.2
11	+ 5.622	+9.309	-11.990	-15.733	-0.0006	-213	- 6	+0.3577	15.3
12	5.690	9.362	11.746	15.950	6	-171	- 42	.3605	15.3
13	5.776	9.404	11.500	16.163	6	- 86	- 68	.3632	15.4
14	5.871	9.430	11.250	16.371	6	+ 21	- 77	.3659	15.4
15	5.965	9.434	10.998	16.576	5	+123	- 65	.3687	15.5
16	+ 6.048	+9.424	-10.742	-16.776	-0.0005	+197	- 38	+0.3714	15.6
17	+ 6.114	+9.406	-10.483	-16.972	-0.0005	+228	- 4	+0.3742	15.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Apr. 1	+0.6195	9.658	4 21 03	18.849	17 11 00	-7.988	- 67	60	9 08
2	.6270	9.700	4 20 13	18.860	17 06 43	7.959	- 42	64	7 40
3	.6352	9.737	4 19 15	18.872	17 02 28	7.927	- 9	66	6 21
4	.6436	9.764	4 18 07	18.883	16 58 12	7.893	+ 24	64	5 04
5	.6514	9.780	4 16 58	18.897	16 53 58	7.857	+ 51	58	3 38
6	+0.6582	9.786	4 15 54	18.911	16 49 44	-7.818	+ 69	51	1 53
7	.6635	9.784	4 14 57	18.926	16 45 31	7.778	+ 71	47	23 30
8	.6673	9.778	4 14 14	18.941	16 41 19	7.735	+ 56	51	21 05
9	.6694	9.773	4 13 50	18.959	16 37 09	7.690	+ 24	60	19 01
10	.6704	9.774	4 13 40	18.976	16 32 58	7.643	- 19	72	17 21
11	+0.6711	9.789	4 13 43	18.995	16 28 48	-7.594	- 65	80	15 52
12	.6727	9.822	4 13 48	19.015	16 24 39	7.543	-104	84	14 24
13	.6763	9.871	4 13 47	19.036	16 20 31	7.490	-123	82	12 51
14	.6826	9.935	4 13 28	19.059	16 16 23	7.435	-116	78	11 00
15	.6917	10.002	4 12 43	19.083	16 12 17	7.378	- 81	74	9 02
16	+0.7028	10.065	4 11 34	19.106	16 08 10	-7.318	- 28	73	6 57
17	.7146	10.114	4 10 11	19.131	16 04 04	7.257	+ 33	76	4 54
18	.7258	10.146	4 08 42	19.158	15 59 58	7.194	+ 86	80	3 02
19	.7352	10.162	4 07 20	19.184	15 55 53	7.129	+122	84	1 18
20	.7423	10.167	4 06 13	19.211	15 51 48	7.061	+132	86	23 44
21	+0.7470	10.168	4 05 26	19.238	15 47 44	-6.991	+118	86	22 15
22	.7498	10.170	4 04 59	19.265	15 43 41	6.919	+ 84	82	20 48
23	.7516	10.182	4 04 50	19.293	15 39 38	6.846	+ 40	75	19 21
24	.7531	10.205	4 04 52	19.320	15 35 36	6.769	- 7	66	17 43
25	.7556	10.243	4 04 54	19.348	15 31 34	6.691	- 47	57	15 50
26	+0.7596	10.293	4 04 51	19.375	15 27 34	-6.611	- 72	52	13 41
27	.7652	10.351	4 04 38	19.403	15 23 33	6.529	- 81	53	11 30
28	.7727	10.413	4 04 10	19.431	15 19 34	6.445	- 73	59	9 38
29	.7816	10.474	4 03 27	19.457	15 15 36	6.358	- 52	64	8 08
30	.7915	10.530	4 02 30	19.485	15 11 39	6.271	- 21	66	6 48
May 1	+0.8018	10.578	4 01 25	19.512	15 07 43	-6.181	+ 12	65	5 32
2	.8117	10.615	4 00 17	19.539	15 03 48	6.090	+ 42	59	4 12
3	.8209	10.642	3 59 06	19.566	14 59 53	5.997	+ 62	52	2 33
4	.8287	10.659	3 58 05	19.593	14 56 00	5.902	+ 69	45	0 26
5	.8350	10.670	3 57 11	19.620	14 52 07	5.806	+ 59	45	21 51
6	+0.8397	10.679	3 56 31	19.647	14 48 16	-5.708	+ 32	54	19 32
7	.8432	10.690	3 56 06	19.672	14 44 26	5.609	- 7	67	17 44
8	.8461	10.712	3 55 54	19.700	14 40 37	5.509	- 54	79	16 15
9	.8493	10.748	3 55 50	19.727	14 36 48	5.407	- 98	86	14 51
10	.8541	10.803	3 55 45	19.753	14 33 01	5.304	-127	88	13 23
11	+0.8616	10.875	3 55 29	19.781	14 29 14	-5.200	-130	85	11 44
12	.8720	10.956	3 54 50	19.808	14 25 28	5.094	-105	80	9 53
13	.8852	11.036	3 53 46	19.837	14 21 44	4.987	- 53	76	7 47
14	.8998	11.108	3 52 23	19.864	14 17 59	4.879	+ 13	77	5 35
15	.9142	11.162	3 50 47	19.893	14 14 15	4.769	+ 75	81	3 32
16	+0.9269	11.198	3 49 14	19.920	14 10 32	-4.658	+120	87	1 43
17	+0.9371	11.218	3 47 54	19.948	14 06 48	-4.546	+139	91	0 10

BESSELIAN DAY NUMBERS, 1960

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	$d\psi$	$d\epsilon$	τ	S.T.
						(0".001)			
									^h
May 17	+ 6.114	+9.406	-10.483	-16.972	-0.0005	+228	- 4	+0.3742	15.6
18	6.164	9.386	10.221	17.163	5	+216	+ 31	.3769	15.7
19	6.199	9.376	9.955	17.349	5	+166	+ 57	.3796	15.8
20	6.227	9.378	9.687	17.531	5	+ 96	+ 70	.3824	15.8
21	6.252	9.394	9.415	17.707	6	+ 18	+ 69	.3851	15.9
22	+ 6.281	+9.423	- 9.141	-17.879	-0.0006	- 52	+ 54	+0.3878	16.0
23	6.318	9.461	8.863	18.045	6	-102	+ 31	.3906	16.0
24	6.366	9.504	8.583	18.206	6	-125	+ 2	.3933	16.1
25	6.426	9.545	8.301	18.361	6	-121	- 26	.3961	16.2
26	6.496	9.581	8.016	18.510	6	- 91	- 49	.3988	16.2
27	+ 6.573	+9.608	- 7.728	-18.655	-0.0006	- 46	- 63	+0.4015	16.3
28	6.654	9.624	7.439	18.793	5	+ 7	- 67	.4043	16.4
29	6.733	9.627	7.148	18.926	5	+ 58	- 58	.4070	16.4
30	6.809	9.620	6.855	19.053	5	+ 96	- 40	.4097	16.5
31	6.876	9.606	6.560	19.175	5	+113	- 15	.4125	16.6
June 1	+ 6.933	+9.587	- 6.263	-19.290	-0.0005	+104	+ 14	+0.4152	16.6
2	6.980	9.570	5.966	19.400	5	+ 68	+ 41	.4180	16.7
3	7.018	9.560	5.667	19.505	5	+ 9	+ 61	.4207	16.8
4	7.050	9.559	5.367	19.603	5	- 66	+ 70	.4234	16.8
5	7.082	9.573	5.065	19.696	6	-142	+ 65	.4262	16.9
6	+ 7.120	+9.601	- 4.763	-19.784	-0.0006	-203	+ 44	+0.4289	17.0
7	7.172	9.642	4.461	19.866	6	-230	+ 11	.4316	17.0
8	7.242	9.687	4.157	19.943	6	-210	- 28	.4344	17.1
9	7.333	9.726	3.853	20.015	5	-141	- 60	.4371	17.2
10	7.437	9.748	3.548	20.082	5	- 38	- 77	.4399	17.2
11	+ 7.546	+9.750	- 3.241	-20.144	-0.0005	+ 76	- 74	+0.4426	17.3
12	7.647	9.732	2.934	20.201	5	+170	- 52	.4453	17.4
13	7.733	9.701	2.627	20.252	5	+225	- 17	.4481	17.4
14	7.799	9.666	2.318	20.299	5	+230	+ 21	.4508	17.5
15	7.849	9.638	2.008	20.340	5	+193	+ 52	.4536	17.6
16	+ 7.886	+9.623	- 1.697	-20.375	-0.0005	+126	+ 69	+0.4563	17.6
17	7.919	9.621	1.385	20.405	5	+ 48	+ 72	.4590	17.7
18	7.955	9.633	1.072	20.429	5	- 25	+ 61	.4618	17.7
19	7.998	9.656	0.759	20.447	5	- 80	+ 38	.4645	17.8
20	8.049	9.683	0.445	20.459	5	-112	+ 11	.4672	17.9
21	+ 8.113	+9.711	- 0.131	-20.466	-0.0005	-115	- 18	+0.4700	17.9
22	8.186	9.735	+ 0.183	20.466	5	- 92	- 44	.4727	18.0
23	8.267	9.749	0.497	20.460	5	- 51	- 60	.4755	18.1
24	8.352	9.753	0.811	20.448	5	+ 1	- 67	.4782	18.1
25	8.437	9.744	1.125	20.431	5	+ 53	- 62	.4809	18.2
26	+ 8.519	+9.725	+ 1.438	-20.407	-0.0004	+ 95	- 47	+0.4837	18.3
27	8.592	9.696	1.751	20.377	4	+118	- 23	.4864	18.3
28	8.656	9.663	2.063	20.342	4	+117	+ 5	.4891	18.4
29	8.708	9.629	2.374	20.300	4	+ 88	+ 33	.4919	18.5
30	8.750	9.600	2.685	20.253	4	+ 34	+ 55	.4946	18.5
July 1	+ 8.786	+9.580	+ 2.994	-20.199	-0.0004	- 38	+ 68	+0.4974	18.6
2	+ 8.818	+9.572	+ 3.302	-20.140	-0.0005	-117	+ 68	+0.5001	18.7

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
May 17	+0.9371	11.218	3 47 54	19.948	14 06 48	-4.546	+139	91	0 10
18	.9448	11.229	3 46 50	19.976	14 03 06	4.432	+132	91	22 41
19	.9501	11.240	3 46 07	20.002	13 59 23	4.317	+102	87	21 17
20	.9544	11.257	3 45 40	20.029	13 55 41	4.201	+ 59	80	19 54
21	.9582	11.284	3 45 25	20.054	13 52 00	4.083	+ 11	69	18 24
22	+0.9626	11.324	3 45 16	20.080	13 48 19	-3.964	- 32	58	16 36
23	.9683	11.377	3 45 04	20.104	13 44 38	3.844	- 62	51	14 29
24	.9757	11.439	3 44 44	20.128	13 40 58	3.722	- 76	50	12 09
25	.9849	11.507	3 44 12	20.150	13 37 19	3.600	- 74	55	10 06
26	0.9957	11.576	3 43 27	20.171	13 33 40	3.476	- 56	61	8 26
27	+1.0075	11.641	3 42 30	20.192	13 30 00	-3.351	- 28	66	7 05
28	.0198	11.700	3 41 22	20.212	13 26 23	3.226	+ 4	67	5 50
29	.0321	11.748	3 40 08	20.231	13 22 46	3.100	+ 35	62	4 33
30	.0436	11.786	3 38 50	20.249	13 19 09	2.973	+ 59	55	3 05
31	.0539	11.813	3 37 37	20.266	13 15 33	2.845	+ 69	47	1 14
June 1	+1.0627	11.831	3 36 31	20.282	13 11 57	-2.716	+ 64	44	22 45
2	.0699	11.845	3 35 35	20.297	13 08 22	2.587	+ 42	49	20 14
3	.0757	11.859	3 34 52	20.312	13 04 48	2.458	+ 6	61	18 14
4	.0806	11.878	3 34 22	20.325	13 01 15	2.327	- 40	75	16 38
5	.0855	11.908	3 34 02	20.337	12 57 41	2.196	- 87	86	15 16
6	+1.0913	11.953	3 33 46	20.349	12 54 09	-2.066	-124	92	13 54
7	.0992	12.017	3 33 26	20.361	12 50 37	1.935	-141	92	12 27
8	.1101	12.095	3 32 52	20.372	12 47 06	1.803	-128	88	10 46
9	.1240	12.181	3 31 57	20.382	12 43 35	1.671	- 86	82	8 52
10	.1400	12.261	3 30 38	20.393	12 40 05	1.539	- 23	78	6 44
11	+1.1568	12.329	3 29 03	20.403	12 36 34	-1.405	+ 46	80	4 31
12	.1723	12.377	3 27 22	20.413	12 33 03	1.272	+104	85	2 30
13	.1854	12.406	3 25 46	20.422	12 29 34	1.139	+138	91	0 43
14	.1956	12.420	3 24 25	20.431	12 26 03	1.005	+141	94	23 08
15	.2031	12.430	3 23 22	20.439	12 22 33	0.871	+118	93	21 44
16	+1.2089	12.441	3 22 40	20.446	12 19 03	-0.736	+ 77	85	20 24
17	.2140	12.461	3 22 10	20.452	12 15 32	0.601	+ 29	74	18 59
18	.2194	12.493	3 21 48	20.457	12 12 01	0.465	- 15	62	17 23
19	.2260	12.538	3 21 28	20.461	12 08 30	0.329	- 49	50	15 20
20	.2339	12.591	3 21 04	20.464	12 04 59	0.193	- 69	46	12 55
21	+1.2436	12.654	3 20 30	20.467	12 01 28	-0.057	- 70	49	10 34
22	.2549	12.719	3 19 46	20.467	11 57 57	+0.079	- 56	57	8 39
23	.2673	12.782	3 18 49	20.466	11 54 26	0.216	- 31	63	7 15
24	.2804	12.840	3 17 42	20.464	11 50 55	0.352	+ 1	67	5 59
25	.2935	12.889	3 16 27	20.462	11 47 24	0.488	+ 32	65	4 45
26	+1.3059	12.929	3 15 08	20.458	11 43 53	+0.624	+ 58	60	3 25
27	.3171	12.955	3 13 49	20.452	11 40 21	0.759	+ 72	52	1 44
28	.3270	12.973	3 12 35	20.446	11 36 50	0.895	+ 72	47	23 35
29	.3350	12.983	3 11 30	20.438	11 33 19	1.030	+ 54	48	21 07
30	.3415	12.989	3 10 37	20.430	11 29 48	1.164	+ 21	57	18 55
July 1	+1.3469	12.999	3 09 54	20.420	11 26 17	+1.298	- 23	70	17 10
2	+1.3518	13.015	3 09 24	20.409	11 22 46	+1.432	- 72	82	15 43

Date	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>dψ</i>	<i>dε</i>	<i>τ</i>	S.T.
						(0 ^h .001)			^h
July	1	-11.256	+9.580	+2.998	-20.199	-0.0004	-38 + 68	-0.5026	18.6
	2	11.224	9.572	3.306	20.140	5	-117 + 68	.4999	18.7
	3	11.188	9.579	3.613	20.075	5	-186 + 53	.4972	18.7
	4	11.142	9.598	3.918	20.005	5	-229 + 25	.4944	18.8
	5	11.081	9.624	4.222	19.930	5	-233 - 11	.4917	18.9
	6	-11.000	+9.650	+4.524	-19.850	-0.0005	-188 - 47	-0.4890	18.9
	7	10.903	9.665	4.825	19.765	4	-101 - 72	.4862	19.0
	8	10.796	9.661	5.124	19.674	4	+11 - 79	.4835	19.1
	9	10.692	9.635	5.422	19.579	4	+119 - 65	.4807	19.1
	10	10.599	9.591	5.718	19.478	4	+197 - 33	.4780	19.2
	11	-10.526	+9.539	+6.014	-19.373	-0.0004	+227 + 6	-0.4753	19.3
	12	10.472	9.490	6.308	19.263	4	+208 + 42	.4725	19.3
	13	10.434	9.453	6.601	19.147	4	+152 + 65	.4698	19.4
	14	10.404	9.430	6.892	19.027	4	+76 + 74	.4670	19.5
	15	10.374	9.423	7.182	18.901	4	+1 + 67	.4643	19.5
	16	-10.340	+9.428	+7.471	-18.770	-0.0004	-61 + 47	-0.4616	19.6
	17	10.296	9.439	7.757	18.633	4	-99 + 20	.4588	19.7
	18	10.241	9.453	8.042	18.491	4	-109 - 10	.4561	19.7
	19	10.177	9.463	8.325	18.343	4	-93 - 36	.4534	19.8
	20	10.104	9.467	8.606	18.190	4	-55 - 56	.4506	19.9
	21	-10.027	+9.459	+8.884	-18.031	-0.0004	-5 - 65	-0.4479	19.9
	22	9.948	9.440	9.160	17.867	4	+49 - 64	.4451	20.0
	23	9.874	9.410	9.434	17.698	4	+95 - 51	.4424	20.0
	24	9.807	9.371	9.704	17.524	4	+124 - 30	.4397	20.1
	25	9.749	9.325	9.972	17.344	4	+130 - 3	.4369	20.2
	26	-9.703	+9.279	+10.237	-17.159	-0.0004	+108 + 25	-0.4342	20.2
	27	9.668	9.235	10.499	16.969	4	+60 + 50	.4315	20.3
	28	9.641	9.201	10.757	16.774	4	-8 + 65	.4287	20.4
	29	9.618	9.179	11.013	16.574	4	-86 + 68	.4260	20.4
	30	9.595	9.170	11.265	16.370	4	-159 + 57	.4232	20.5
Aug.	31	-9.564	+9.174	+11.513	-16.161	-0.0004	-213 + 34	-0.4205	20.6
	1	9.520	9.187	11.758	15.948	4	-233 + 1	.4178	20.6
	2	9.460	9.202	12.000	15.730	4	-210 - 34	.4150	20.7
	3	9.383	9.211	12.237	15.509	4	-144 - 63	.4123	20.8
	4	9.294	9.205	12.472	15.283	4	-46 - 77	.4096	20.8
	5	-9.202	+9.179	+12.703	-15.054	-0.0004	+62 - 72	-0.4068	20.9
	6	9.117	9.135	12.931	14.821	4	+153 - 48	.4041	21.0
	7	9.047	9.079	13.155	14.585	4	+206 - 12	.4013	21.0
	8	8.998	9.019	13.376	14.344	4	+209 + 27	.3986	21.1
	9	8.967	8.968	13.593	14.100	4	+168 + 58	.3959	21.2
	10	-8.948	+8.932	+13.808	-13.852	-0.0004	+99 + 73	-0.3931	21.2
	11	8.933	8.913	14.019	13.600	4	+21 + 72	.3904	21.3
	12	8.913	8.909	14.227	13.344	4	-46 + 56	.3877	21.4
	13	8.886	8.914	14.431	13.084	4	-90 + 30	.3849	21.4
	14	8.849	8.924	14.631	12.820	4	-108 0	.3822	21.5
	15	-8.801	+8.933	+14.828	-12.552	-0.0005	-98 - 29	-0.3794	21.6
	16	-8.744	+8.935	+15.020	-12.279	-0.0005	-64 - 51	-0.3767	21.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^h ^m ^s	["]	^h ^m ^s	["]	(0 ^s .0001)	(0 ["] .001)	^h ^m
July 1	-1.7266	14.781	9 18 24	20.420	11 26 14	+1.300	- 23	70	17 10
2	.7217	14.751	9 18 10	20.410	11 22 43	1.434	- 72	82	15 43
3	.7162	14.729	9 17 43	20.398	11 19 11	1.567	-114	91	14 22
4	.7091	14.706	9 17 02	20.385	11 15 41	1.699	-140	94	13 01
5	.6997	14.677	9 16 06	20.372	11 12 09	1.831	-143	93	11 33
6	-1.6874	14.633	9 14 58	20.359	11 08 39	+1.962	-115	88	9 51
7	.6725	14.570	9 13 47	20.345	11 05 08	2.092	- 62	83	7 57
8	.6561	14.488	9 12 42	20.330	11 01 36	2.222	+ 7	79	5 47
9	.6400	14.393	9 11 55	20.316	10 58 05	2.351	+ 73	80	3 36
10	.6258	14.294	9 11 26	20.300	10 54 34	2.480	+120	85	1 31
11	-1.6145	14.205	9 11 16	20.285	10 51 01	+2.608	+139	90	23 45
12	.6064	14.132	9 11 16	20.270	10 47 28	2.736	+127	93	22 12
13	.6005	14.079	9 11 18	20.253	10 43 55	2.863	+ 93	89	20 52
14	.5959	14.042	9 11 15	20.237	10 40 21	2.989	+ 46	80	19 29
15	.5913	14.015	9 11 00	20.219	10 36 47	3.115	+ 1	67	18 01
16	-1.5861	13.993	9 10 34	20.202	10 33 11	+3.240	- 37	53	16 11
17	.5793	13.968	9 09 57	20.183	10 29 36	3.364	- 61	44	13 48
18	.5709	13.937	9 09 10	20.164	10 25 59	3.487	- 67	45	11 08
19	.5611	13.897	9 08 20	20.144	10 22 21	3.610	- 57	52	9 03
20	.5499	13.846	9 07 27	20.123	10 18 43	3.732	- 34	60	7 25
21	-1.5380	13.785	9 06 41	20.101	10 15 05	+3.853	- 3	65	6 07
22	.5260	13.714	9 06 00	20.078	10 11 26	3.972	+ 30	67	4 52
23	.5146	13.640	9 05 31	20.055	10 07 46	4.091	+ 58	63	3 34
24	.5043	13.564	9 05 13	20.032	10 04 06	4.208	+ 76	58	2 05
25	.4954	13.491	9 05 06	20.006	10 00 25	4.324	+ 80	52	0 13
26	-1.4883	13.426	9 05 07	19.981	9 56 43	+4.439	+ 66	50	21 59
27	.4830	13.370	9 05 15	19.954	9 53 01	4.553	+ 37	55	19 42
28	.4788	13.327	9 05 21	19.927	9 49 19	4.665	- 5	65	17 49
29	.4754	13.295	9 05 21	19.899	9 45 35	4.776	- 53	76	16 13
30	.4719	13.272	9 05 11	19.871	9 41 52	4.885	- 97	85	14 48
31	-1.4671	13.253	9 04 46	19.842	9 38 08	+4.993	-130	91	13 27
Aug. 1	.4604	13.230	9 04 05	19.814	9 34 24	5.099	-143	93	12 02
2	.4511	13.197	9 03 10	19.785	9 30 39	5.204	-128	90	10 31
3	.4394	13.148	9 02 07	19.755	9 26 54	5.307	- 88	85	8 49
4	.4257	13.081	9 01 06	19.726	9 23 08	5.409	- 28	79	6 53
5	-1.4115	12.997	9 00 17	19.697	9 19 22	+5.509	+ 38	76	4 44
6	.3985	12.906	8 59 46	19.669	9 15 35	5.608	+ 94	78	2 33
7	.3878	12.817	8 59 36	19.641	9 11 48	5.705	+126	83	0 33
8	.3803	12.740	8 59 44	19.613	9 08 00	5.801	+128	87	22 48
9	.3755	12.682	8 59 59	19.585	9 04 12	5.895	+103	89	21 16
10	-1.3726	12.643	9 00 12	19.559	9 00 22	+5.988	+ 61	83	19 53
11	.3703	12.619	9 00 15	19.532	8 56 31	6.079	+ 13	73	18 27
12	.3673	12.602	9 00 03	19.506	8 52 40	6.170	- 28	59	16 48
13	.3632	12.587	8 59 38	19.479	8 48 47	6.258	- 55	47	14 40
14	.3574	12.568	8 59 02	19.453	8 44 54	6.345	- 66	43	12 00
15	-1.3501	12.540	8 58 17	19.427	8 41 00	+6.430	- 60	49	9 33
16	-1.3414	12.502	8 57 31	19.400	8 37 04	+6.514	- 39	57	7 46

Date	A	B	C	D	E	$d\psi$	$d\epsilon$	τ	S.T.
						(0".001)			
					^s				^h
Aug. 16	- 8.744	+8.935	+15.020	-12.279	-0.0005	- 64	- 51	-0.3767	21.6
17	8.682	8.928	15.209	12.003	4	- 16	- 63	.3740	21.7
18	8.618	8.910	15.393	11.723	4	+ 38	- 65	.3712	21.8
19	8.556	8.882	15.573	11.439	4	+ 89	- 56	.3685	21.8
20	8.501	8.843	15.749	11.151	4	+124	- 36	.3657	21.9
21	- 8.455	+8.798	+15.920	-10.860	-0.0004	+138	- 10	-0.3630	22.0
22	8.420	8.751	16.086	10.566	5	+125	+ 18	.3603	22.0
23	8.396	8.707	16.248	10.268	5	+ 84	+ 44	.3575	22.1
24	8.382	8.671	16.405	9.967	5	+ 21	+ 62	.3548	22.2
25	8.374	8.646	16.557	9.663	5	- 56	+ 69	.3521	22.2
26	- 8.365	+8.636	+16.703	- 9.356	-0.0005	-131	+ 61	-0.3493	22.3
27	8.351	8.639	16.845	9.047	5	-190	+ 41	.3466	22.3
28	8.325	8.654	16.981	8.734	5	-219	+ 10	.3438	22.4
29	8.285	8.671	17.113	8.420	5	-210	- 24	.3411	22.5
30	8.228	8.685	17.239	8.103	5	-160	- 54	.3384	22.5
31	- 8.159	+8.688	+17.360	- 7.785	-0.0005	- 78	- 72	-0.3356	22.6
Sept. 1	8.085	8.675	17.477	7.464	5	+ 21	- 74	.3329	22.7
2	8.012	8.643	17.588	7.141	5	+114	- 57	.3302	22.7
3	7.951	8.598	17.695	6.817	5	+179	- 26	.3274	22.8
4	7.908	8.546	17.797	6.491	5	+200	+ 12	.3247	22.9
5	- 7.884	+8.498	+17.895	- 6.164	-0.0005	+175	+ 47	-0.3219	22.9
6	7.874	8.463	17.988	5.835	6	+116	+ 69	.3192	23.0
7	7.870	8.445	18.076	5.504	6	+ 40	+ 75	.3165	23.1
8	7.866	8.445	18.159	5.171	6	- 33	+ 64	.3137	23.1
9	7.854	8.457	18.238	4.836	6	- 86	+ 40	.3110	23.2
10	- 7.832	+8.476	+18.312	- 4.499	-0.0006	-113	+ 11	-0.3083	23.3
11	7.798	8.496	18.381	4.161	6	-109	- 19	.3055	23.3
12	7.755	8.513	18.444	3.821	6	- 81	- 45	.3028	23.4
13	7.704	8.520	18.503	3.479	6	- 34	- 61	.3000	23.5
14	7.651	8.516	18.556	3.136	6	+ 20	- 66	.2973	23.5
15	- 7.598	+8.503	+18.604	- 2.791	-0.0006	+ 74	- 60	-0.2946	23.6
16	7.550	8.479	18.647	2.445	6	+116	- 43	.2918	23.7
17	7.509	8.448	18.684	2.097	6	+138	- 19	.2891	23.7
18	7.480	8.414	18.715	1.749	7	+134	+ 10	.2863	23.8
19	7.461	8.381	18.740	1.400	7	+102	+ 37	.2836	23.9
20	- 7.453	+8.356	+18.760	- 1.049	-0.0007	+ 45	+ 58	-0.2809	23.9
21	7.451	8.341	18.774	0.699	7	- 28	+ 69	.2781	0.0
22	7.451	8.342	18.783	- 0.347	7	-105	+ 65	.2754	0.1
23	7.446	8.356	18.785	+ 0.004	7	-170	+ 48	.2727	0.1
24	7.429	8.384	18.781	0.355	8	-207	+ 18	.2699	0.2
25	- 7.398	+8.417	+18.772	+ 0.707	-0.0008	-206	- 16	-0.2672	0.3
26	7.350	8.447	18.756	1.058	8	-164	- 47	.2644	0.3
27	7.289	8.469	18.735	1.408	8	- 89	- 69	.2617	0.4
28	7.221	8.475	18.709	1.758	8	+ 4	- 74	.2590	0.5
29	7.154	8.464	18.677	2.107	8	+ 95	- 62	.2562	0.5
30	- 7.095	+8.440	+18.640	+ 2.455	-0.0008	+163	- 36	-0.2535	0.6
Oct. 1	- 7.051	+8.406	+18.598	+ 2.802	-0.0008	+194	0	-0.2508	0.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Aug. 16	-1.3414	12.502	8 57 31	19.400	8 37 04	+6.514	- 39	57	7 46
17	.3319	12.453	8 56 48	19.375	8 33 07	6.596	- 10	63	6 23
18	.3221	12.396	8 56 11	19.349	8 29 10	6.675	+ 23	67	5 08
19	.3125	12.333	8 55 43	19.323	8 25 11	6.753	+ 54	66	3 51
20	.3041	12.266	8 55 29	19.297	8 21 12	6.830	+ 76	61	2 25
21	-1.2970	12.202	8 55 27	19.271	8 17 12	+6.904	+ 84	56	0 41
22	.2916	12.144	8 55 35	19.246	8 13 12	6.976	+ 76	53	22 40
23	.2881	12.096	8 55 50	19.221	8 09 10	7.046	+ 51	55	20 29
24	.2859	12.060	8 56 07	19.195	8 05 07	7.114	+ 13	63	18 31
25	.2847	12.037	8 56 20	19.171	8 01 04	7.180	- 34	73	16 48
26	-1.2834	12.023	8 56 21	19.145	7 57 01	+7.243	- 80	80	15 18
27	.2812	12.015	8 56 07	19.121	7 52 57	7.305	-116	86	13 54
28	.2772	12.008	8 55 34	19.096	7 48 52	7.364	-134	88	12 26
29	.2710	11.993	8 54 47	19.072	7 44 47	7.421	-128	87	10 56
30	.2624	11.964	8 53 49	19.048	7 40 42	7.476	- 98	83	9 19
31	-1.2518	11.918	8 52 48	19.026	7 36 37	+7.528	- 48	78	7 33
Sept. 1	.2403	11.858	8 51 56	19.004	7 32 30	7.579	+ 13	74	5 34
2	.2292	11.785	8 51 19	18.983	7 28 23	7.627	+ 70	73	3 26
3	.2199	11.711	8 51 02	18.963	7 24 16	7.674	+109	76	1 20
4	.2133	11.643	8 51 07	18.944	7 20 09	7.718	+122	80	23 26
5	-1.2096	11.592	8 51 25	18.927	7 16 01	+7.760	+107	84	21 44
6	.2080	11.559	8 51 44	18.911	7 11 53	7.801	+ 71	83	20 15
7	.2075	11.544	8 51 55	18.896	7 07 44	7.839	+ 24	77	18 48
8	.2069	11.541	8 51 52	18.881	7 03 35	7.875	- 20	65	17 14
9	.2051	11.542	8 51 32	18.868	6 59 24	7.909	- 53	53	15 18
10	-1.2017	11.540	8 50 57	18.857	6 55 13	+7.941	- 69	46	12 55
11	.1965	11.532	8 50 11	18.846	6 51 01	7.971	- 67	47	10 25
12	.1899	11.516	8 49 20	18.836	6 46 49	7.998	- 50	55	8 22
13	.1821	11.487	8 48 29	18.827	6 42 36	8.024	- 21	62	6 50
14	.1739	11.448	8 47 45	18.819	6 38 22	8.047	+ 12	66	5 32
15	-1.1658	11.403	8 47 08	18.812	6 34 08	+8.068	+ 45	67	4 16
16	.1584	11.353	8 46 44	18.807	6 29 53	8.086	+ 71	63	2 52
17	.1522	11.303	8 46 32	18.802	6 25 37	8.102	+ 84	58	1 16
18	.1477	11.258	8 46 33	18.797	6 21 21	8.116	+ 82	54	23 17
19	.1449	11.221	8 46 42	18.792	6 17 05	8.127	+ 62	55	21 11
20	-1.1436	11.197	8 46 55	18.789	6 12 48	+8.135	+ 28	61	19 09
21	.1434	11.184	8 47 06	18.787	6 08 32	8.141	- 17	70	17 23
22	.1433	11.185	8 47 05	18.786	6 04 14	8.145	- 64	77	15 49
23	.1425	11.192	8 46 49	18.785	5 59 57	8.146	-104	83	14 22
24	.1401	11.202	8 46 10	18.784	5 55 40	8.145	-127	84	12 49
25	-1.1353	11.206	8 45 15	18.785	5 51 22	+8.141	-126	83	11 16
26	.1279	11.197	8 44 07	18.786	5 47 05	8.134	-100	80	9 37
27	.1186	11.174	8 42 52	18.788	5 42 49	8.125	- 54	78	7 49
28	.1081	11.134	8 41 44	18.792	5 38 32	8.113	+ 2	74	5 55
29	.0978	11.082	8 40 49	18.796	5 34 15	8.099	+ 58	72	3 55
30	-1.0888	11.026	8 40 12	18.801	5 29 59	+8.083	+100	74	1 56
Oct. 1	-1.0821	10.972	8 39 58	18.808	5 25 44	+8.065	+119	77	0 00

Date	A	B	C	D	E	$d\psi$	$d\epsilon$	τ	S.T.
						(0 ^{''} .001)			^h
Oct. 1	- 7 ^h .051	+8 ^h .406	+18 ^h .598	+ 2 ^h .802	-0.0008	+194	0	-0.2508	0.6
2	7.024	8.375	18.550	3.148	8	+182	+ 35	.2480	0.7
3	7.012	8.351	18.497	3.493	8	+132	+ 62	.2453	0.8
4	7.009	8.344	18.439	3.837	8	+ 60	+ 74	.2425	0.8
5	7.007	8.354	18.377	4.181	8	- 17	+ 69	.2398	0.9
6	- 6.999	+8.378	+18.309	+ 4.523	-0.0008	- 79	+ 50	-0.2371	1.0
7	6.981	8.414	18.235	4.865	9	-116	+ 21	.2343	1.0
8	6.950	8.450	18.157	5.205	9	-122	- 9	.2316	1.1
9	6.909	8.486	18.073	5.545	9	-101	- 37	.2289	1.2
10	6.858	8.514	17.985	5.883	9	- 58	- 57	.2261	1.2
11	- 6.802	+8.531	+17.891	+ 6.221	-0.0009	- 3	- 66	-0.2234	1.3
12	6.745	8.538	17.791	6.557	9	+ 53	- 64	.2206	1.4
13	6.691	8.534	17.686	6.891	9	+100	- 50	.2179	1.4
14	6.644	8.522	17.575	7.224	9	+130	- 28	.2152	1.5
15	6.607	8.505	17.459	7.556	9	+134	0	.2124	1.6
16	- 6.579	+8.488	+17.338	+ 7.885	-0.0009	+112	+ 28	-0.2097	1.6
17	6.562	8.475	17.211	8.213	9	+ 63	+ 52	.2069	1.7
18	6.553	8.472	17.078	8.538	9	- 6	+ 67	.2042	1.8
19	6.546	8.483	16.940	8.861	9	- 83	+ 69	.2015	1.8
20	6.536	8.510	16.796	9.182	10	-154	+ 55	.1987	1.9
21	- 6.517	+8.548	+16.647	+ 9.500	-0.0010	-201	+ 30	-0.1960	2.0
22	6.482	8.597	16.492	9.815	10	-211	- 5	.1933	2.0
23	6.428	8.646	16.332	10.127	10	-176	- 40	.1905	2.1
24	6.360	8.685	16.167	10.435	10	-104	- 65	.1878	2.2
25	6.281	8.711	15.996	10.740	10	- 10	- 76	.1850	2.2
26	- 6.202	+8.717	+15.820	+11.042	-0.0010	+ 87	- 67	-0.1823	2.3
27	6.131	8.708	15.640	11.340	10	+161	- 43	.1796	2.4
28	6.072	8.690	15.455	11.634	10	+200	- 9	.1768	2.4
29	6.031	8.670	15.266	11.925	10	+196	+ 27	.1741	2.5
30	6.004	8.657	15.072	12.211	10	+154	+ 56	.1714	2.6
31	- 5.987	+8.657	+14.874	+12.495	-0.0010	+ 85	+ 72	-0.1686	2.6
Nov. 1	5.974	8.674	14.672	12.774	10	+ 8	+ 72	.1659	2.7
2	5.956	8.704	14.465	13.050	10	- 63	+ 58	.1631	2.8
3	5.929	8.747	14.255	13.322	10	-110	+ 32	.1604	2.8
4	5.889	8.795	14.040	13.591	10	-128	+ 1	.1577	2.9
5	- 5.837	+8.842	+13.821	+13.855	-0.0010	-116	- 29	-0.1549	2.9
6	5.774	8.882	13.598	14.116	10	- 79	- 52	.1522	3.0
7	5.705	8.912	13.371	14.373	10	- 27	- 65	.1495	3.1
8	5.633	8.931	13.140	14.626	10	+ 31	- 67	.1467	3.1
9	5.562	8.938	12.904	14.876	10	+ 83	- 57	.1440	3.2
10	- 5.498	+8.935	+12.664	+15.121	-0.0010	+118	- 37	-0.1412	3.3
11	5.441	8.926	12.420	15.362	10	+131	- 11	.1385	3.3
12	5.394	8.914	12.172	15.599	10	+118	+ 18	.1358	3.4
13	5.358	8.906	11.919	15.831	10	+ 77	+ 43	.1330	3.5
14	5.330	8.903	11.663	16.059	10	+ 14	+ 62	.1303	3.5
15	- 5.306	+8.913	+11.402	+16.282	-0.0010	- 62	+ 69	-0.1275	3.6
16	- 5.283	+8.935	+11.137	+16.499	-0.0010	-139	+ 63	-0.1248	3.7

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^h ^m ^s	["]	^h ^m ^s	⁺ ["]	(0 ^s .0001)	(0 ["] .001)	^h ^m
Oct. 1	-1.0821	10.972	8 39 58	18.808	5 25 44	+8.065	+119	77	0 00
2	.0779	10.931	8 39 57	18.815	5 21 28	8.044	+111	80	22 17
3	.0761	10.904	8 40 05	18.824	5 17 13	8.021	+ 81	81	20 41
4	.0756	10.897	8 40 07	18.834	5 12 59	7.996	+ 37	78	19 12
5	.0754	10.904	8 39 57	18.847	5 08 44	7.969	- 10	69	17 37
6	-1.0742	10.917	8 39 30	18.860	5 04 30	+7.940	- 48	59	15 51
7	.0714	10.933	8 38 44	18.873	5 00 15	7.908	- 71	51	13 38
8	.0667	10.941	8 37 45	18.889	4 56 01	7.874	- 75	49	11 18
9	.0603	10.943	8 36 36	18.905	4 51 47	7.838	- 62	55	9 09
10	.0525	10.933	8 35 24	18.923	4 47 33	7.799	- 35	62	7 28
11	-1.0439	10.911	8 34 16	18.942	4 43 18	+7.759	- 2	66	6 04
12	.0352	10.881	8 33 14	18.961	4 39 05	7.715	+ 32	67	4 47
13	.0270	10.844	8 32 23	18.981	4 34 51	7.670	+ 61	64	3 26
14	.0198	10.806	8 31 46	19.002	4 30 37	7.622	+ 80	59	1 54
15	.0141	10.770	8 31 22	19.024	4 26 23	7.571	+ 82	53	0 00
16	-1.0099	10.739	8 31 07	19.047	4 22 11	+7.519	+ 69	53	21 52
17	.0073	10.719	8 31 00	19.070	4 17 58	7.464	+ 39	58	19 43
18	.0058	10.711	8 30 53	19.093	4 13 45	7.406	- 4	67	17 52
19	.0048	10.715	8 30 37	19.118	4 09 33	7.346	- 51	76	16 18
20	.0034	10.730	8 30 06	19.142	4 05 21	7.284	- 94	83	14 48
21	-1.0003	10.749	8 29 17	19.167	4 01 09	+7.219	-123	85	13 22
22	0.9950	10.767	8 28 04	19.192	3 56 58	7.152	-129	84	11 46
23	.9867	10.774	8 26 31	19.217	3 52 48	7.083	-108	81	10 01
24	.9762	10.765	8 24 51	19.242	3 48 38	7.011	- 64	77	8 10
25	.9642	10.739	8 23 10	19.267	3 44 29	6.937	- 6	76	6 12
26	-0.9520	10.698	8 21 43	19.292	3 40 21	+6.860	+ 53	75	4 11
27	.9411	10.650	8 20 35	19.319	3 36 14	6.782	+ 98	77	2 16
28	.9322	10.601	8 19 46	19.345	3 32 07	6.702	+122	80	0 26
29	.9259	10.561	8 19 17	19.371	3 28 01	6.620	+120	83	22 44
30	.9218	10.535	8 18 58	19.398	3 23 57	6.536	+ 94	83	21 10
31	-0.9192	10.526	8 18 40	19.426	3 19 52	+6.450	+ 52	80	19 41
Nov. 1	.9171	10.532	8 18 13	19.454	3 15 49	6.363	+ 5	72	18 10
2	.9144	10.547	8 17 32	19.482	3 11 47	6.273	- 39	63	16 26
3	.9103	10.567	8 16 31	19.511	3 07 45	6.182	- 67	54	14 25
4	.9042	10.585	8 15 13	19.541	3 03 44	6.089	- 78	51	12 04
5	-0.8962	10.595	8 13 43	19.570	2 59 43	+5.994	- 71	54	9 51
6	.8865	10.594	8 12 07	19.600	2 55 43	5.897	- 48	61	8 04
7	.8759	10.582	8 10 30	19.631	2 51 44	5.798	- 17	66	6 37
8	.8648	10.559	8 08 58	19.662	2 47 45	5.698	+ 19	68	5 18
9	.8540	10.527	8 07 34	19.693	2 43 45	5.596	+ 51	66	4 00
10	-0.8441	10.491	8 06 25	19.724	2 39 47	+5.492	+ 72	60	2 33
11	.8354	10.454	8 05 28	19.755	2 35 49	5.386	+ 80	53	0 48
12	.8282	10.419	8 04 43	19.786	2 31 52	5.278	+ 72	50	22 36
13	.8227	10.394	8 04 08	19.816	2 27 54	5.169	+ 47	53	20 22
14	.8184	10.377	8 03 38	19.847	2 23 57	5.058	+ 9	62	18 21
15	-0.8148	10.373	8 03 04	19.877	2 20 01	+4.945	- 38	73	16 41
16	-0.8111	10.380	8 02 23	19.906	2 16 05	+4.830	- 85	84	15 15

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	$d\psi$	$d\epsilon$	τ	S.T.
					^s	(0".001)			^h
Nov. 16	- 5.283	+8.935	+11.137	+16.499	-0.0010	-139	+ 63	-0.1248	3.7
17	5.251	8.973	10.869	16.712	11	-198	+ 41	.1221	3.7
18	5.206	9.021	10.596	16.919	11	-225	+ 9	.1193	3.8
19	5.142	9.074	10.320	17.121	11	-205	- 28	.1166	3.9
20	5.059	9.120	10.040	17.317	10	-141	- 59	.1139	3.9
21	- 4.963	+9.153	+ 9.757	+17.508	-0.0010	- 44	- 77	-0.1111	4.0
22	4.863	9.165	9.471	17.693	10	+ 62	- 74	.1084	4.1
23	4.768	9.158	9.182	17.871	10	+154	- 53	.1056	4.1
24	4.687	9.140	8.890	18.044	10	+208	- 20	.1029	4.2
25	4.623	9.115	8.595	18.211	10	+217	+ 18	.1002	4.3
26	- 4.577	+9.096	+ 8.298	+18.372	-0.0010	+182	+ 50	-0.0974	4.3
27	4.542	9.089	7.998	18.527	10	+117	+ 70	.0947	4.4
28	4.511	9.096	7.697	18.676	10	+ 40	+ 75	.0920	4.5
29	4.479	9.119	7.393	18.820	10	- 35	+ 64	.0892	4.5
30	4.439	9.154	7.087	18.958	10	- 91	+ 41	.0865	4.6
Dec. 1	- 4.387	+9.194	+ 6.780	+19.090	-0.0010	-120	+ 11	-0.0837	4.7
2	4.323	9.235	6.470	19.217	10	-119	- 19	.0810	4.7
3	4.248	9.271	6.159	19.338	10	- 90	- 45	.0783	4.8
4	4.165	9.297	5.845	19.454	10	- 42	- 62	.0755	4.9
5	4.078	9.311	5.530	19.564	10	+ 15	- 68	.0728	4.9
6	- 3.991	+9.314	+ 5.213	+19.668	-0.0010	+ 69	- 62	-0.0701	5.0
7	3.909	9.304	4.894	19.766	10	+110	- 45	.0673	5.1
8	3.836	9.287	4.573	19.858	10	+130	- 21	.0646	5.1
9	3.772	9.265	4.250	19.945	10	+125	+ 7	.0618	5.2
10	3.719	9.244	3.926	20.025	10	+ 92	+ 34	.0591	5.2
11	- 3.675	+9.226	+ 3.600	+20.100	-0.0010	+ 35	+ 56	-0.0564	5.3
12	3.637	9.220	3.273	20.168	10	- 38	+ 67	.0536	5.4
13	3.601	9.224	2.944	20.230	10	-117	+ 66	.0509	5.4
14	3.562	9.242	2.614	20.286	10	-187	+ 51	.0482	5.5
15	3.512	9.272	2.282	20.335	10	-231	+ 23	.0454	5.6
16	- 3.446	+9.309	+ 1.950	+20.377	-0.0010	-235	- 12	-0.0427	5.6
17	3.360	9.345	1.616	20.413	10	-191	- 48	.0399	5.7
18	3.258	9.370	1.281	20.441	9	-104	- 73	.0372	5.8
19	3.145	9.377	0.946	20.463	9	+ 8	- 80	.0345	5.8
20	3.034	9.361	0.610	20.478	9	+116	- 66	.0317	5.9
21	- 2.935	+9.328	+ 0.275	+20.486	-0.0009	+194	- 35	-0.0290	6.0
22	2.854	9.285	- 0.061	20.487	9	+225	+ 5	.0262	6.0
23	2.793	9.246	0.396	20.481	9	+207	+ 41	.0235	6.1
24	2.748	9.215	0.730	20.468	9	+150	+ 67	.0208	6.2
25	2.710	9.201	1.064	20.449	9	+ 73	+ 76	.0180	6.2
26	- 2.673	+9.201	- 1.397	+20.423	-0.0009	- 4	+ 70	-0.0153	6.3
27	2.629	9.216	1.729	20.391	9	- 66	+ 49	.0126	6.4
28	2.576	9.237	2.060	20.353	9	-103	+ 21	.0098	6.4
29	2.512	9.260	2.391	20.309	9	-110	- 10	.0071	6.5
30	2.436	9.279	2.720	20.259	9	- 90	- 38	.0043	6.6
31	- 2.352	+9.290	- 3.048	+20.202	-0.0009	- 48	- 58	-0.0016	6.6
32	- 2.263	+9.289	- 3.376	+20.140	-0.0009	+ 6	- 67	+0.0011	6.7

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Nov. 16	-0.8111	10.380	8 02 23	19.906	2 16 05	+4.830	- 85	84	15 15
17	.8063	10.397	8 01 21	19.935	2 12 09	4.713	-121	89	13 50
18	.7994	10.415	7 59 57	19.963	2 08 14	4.595	-138	90	12 23
19	.7896	10.430	7 58 09	19.991	2 04 19	4.475	-125	86	10 44
20	.7769	10.429	7 56 04	20.017	2 00 25	4.354	- 86	81	8 54
21	-0.7622	10.412	7 53 52	20.043	1 56 31	+4.231	- 27	79	6 51
22	.7468	10.375	7 51 48	20.068	1 52 38	4.107	+ 38	78	4 46
23	.7321	10.325	7 50 01	20.092	1 48 46	3.982	+ 94	81	2 43
24	.7197	10.272	7 48 35	20.115	1 44 55	3.855	+127	85	0 54
25	.7100	10.220	7 47 34	20.138	1 41 04	3.727	+133	88	23 13
26	-0.7029	10.183	7 46 51	20.159	1 37 14	+3.598	+111	88	21 41
27	.6975	10.161	7 46 13	20.180	1 33 24	3.468	+ 72	84	20 14
28	.6928	10.153	7 45 31	20.200	1 29 35	3.338	+ 24	77	18 48
29	.6879	10.160	7 44 38	20.220	1 25 47	3.206	- 21	65	17 11
30	.6817	10.174	7 43 29	20.239	1 21 59	3.073	- 56	55	15 14
Dec. 1	-0.6738	10.187	7 42 02	20.258	1 18 13	+2.940	- 73	49	12 52
2	.6640	10.197	7 40 20	20.277	1 14 26	2.806	- 73	51	10 32
3	.6525	10.198	7 38 28	20.295	1 10 40	2.671	- 55	58	8 34
4	.6397	10.187	7 36 32	20.313	1 06 54	2.535	- 26	64	7 00
5	.6263	10.165	7 34 37	20.331	1 03 08	2.398	+ 9	68	5 40
6	-0.6131	10.133	7 32 47	20.347	0 59 23	+2.261	+ 42	68	4 25
7	.6005	10.092	7 31 09	20.363	0 55 37	2.122	+ 67	63	3 03
8	.5892	10.048	7 29 46	20.378	0 51 52	1.983	+ 80	56	1 28
9	.5794	10.003	7 28 36	20.393	0 48 07	1.843	+ 76	50	23 28
10	.5712	9.964	7 27 40	20.406	0 44 22	1.703	+ 56	50	21 08
11	-0.5645	9.931	7 26 52	20.420	0 40 37	+1.561	+ 21	58	18 56
12	.5587	9.911	7 26 07	20.432	0 36 52	1.419	- 23	69	17 09
13	.5532	9.902	7 25 18	20.443	0 33 07	1.277	- 72	81	15 39
14	.5472	9.905	7 24 18	20.454	0 29 22	1.134	-114	90	14 18
15	.5395	9.915	7 22 59	20.463	0 25 37	0.990	-141	95	12 56
16	-0.5294	9.926	7 21 15	20.470	0 21 52	+0.846	-144	94	11 31
17	.5163	9.931	7 19 06	20.477	0 18 06	0.701	-117	90	9 51
18	.5005	9.920	7 16 41	20.481	0 14 21	0.556	- 64	84	7 58
19	.4832	9.890	7 14 10	20.485	0 10 35	0.410	+ 5	80	5 51
20	.4662	9.840	7 11 50	20.487	0 06 50	0.265	+ 71	81	3 40
21	-0.4509	9.779	7 09 52	20.488	0 03 05	+0.119	+119	85	1 38
22	.4386	9.714	7 08 21	20.487	23 59 19	-0.026	+138	90	23 47
23	.4292	9.659	7 07 14	20.485	23 55 34	0.172	+127	92	22 14
24	.4223	9.616	7 06 25	20.481	23 51 50	0.317	+ 92	90	20 47
25	.4165	9.592	7 05 39	20.477	23 48 05	0.461	+ 45	81	19 24
26	-0.4108	9.581	7 04 48	20.471	23 44 21	-0.606	- 2	70	17 55
27	.4041	9.584	7 03 41	20.464	23 40 37	0.750	- 40	56	16 07
28	.3960	9.589	7 02 20	20.457	23 36 53	0.893	- 63	46	13 48
29	.3861	9.595	7 00 43	20.449	23 33 08	1.037	- 67	45	11 09
30	.3745	9.593	6 58 50	20.441	23 29 25	1.180	- 55	52	8 53
31	-0.3615	9.583	6 56 50	20.430	23 25 41	-1.322	- 29	61	7 13
32	-0.3479	9.561	6 54 46	20.421	23 21 56	-1.464	+ 4	67	5 52

BESSELIAN DAY NUMBERS, 1960

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Jan. 0	+ 0.062	+9.870	- 3.037	+20.219	Feb. 15	+ 2.532	+9.006	-15.546	+11.481
1	0.136	9.825	3.367	20.156	16	2.545	8.994	15.729	11.183
2	0.191	9.786	3.696	20.086	17	2.563	8.996	15.908	10.881
3	0.233	9.757	4.023	20.010	18	2.593	9.010	16.081	10.577
4	0.269	9.741	4.348	19.927	19	2.638	9.026	16.251	10.268
5	+ 0.305	+9.739	- 4.671	+19.838	20	+ 2.698	+9.039	-16.415	+ 9.957
6	0.345	9.747	4.992	19.743	21	2.771	9.039	16.574	9.642
7	0.394	9.762	5.312	19.642	22	2.848	9.023	16.728	9.324
8	0.453	9.778	5.629	19.535	23	2.921	8.990	16.877	9.002
9	0.521	9.793	5.945	19.422	24	2.982	8.944	17.021	8.678
10	+ 0.598	+9.800	- 6.258	+19.304	25	+ 3.026	+8.892	-17.159	+ 8.351
11	0.681	9.796	6.570	19.179	26	3.052	8.844	17.291	8.021
12	0.765	9.782	6.879	19.049	27	3.065	8.809	17.417	7.688
13	0.847	9.756	7.186	18.913	28	3.070	8.788	17.538	7.353
14	0.923	9.721	7.491	18.772	29	3.076	8.782	17.653	7.016
15	+ 0.989	+9.678	- 7.794	+18.625	Mar. 1	+ 3.087	+8.789	-17.762	+ 6.677
16	1.043	9.631	8.094	18.473	2	3.108	8.804	17.865	6.336
17	1.085	9.590	8.392	18.315	3	3.139	8.820	17.962	5.994
18	1.119	9.557	8.688	18.152	4	3.180	8.834	18.054	5.651
19	1.148	9.537	8.982	17.983	5	3.228	8.842	18.140	5.307
20	+ 1.179	+9.532	- 9.273	+17.809	6	+ 3.282	+8.840	-18.220	+ 4.961
21	1.217	9.539	9.561	17.629	7	3.336	8.828	18.295	4.615
22	1.269	9.556	9.847	17.443	8	3.387	8.806	18.364	4.268
23	1.338	9.573	10.130	17.251	9	3.432	8.774	18.428	3.920
24	1.423	9.581	10.410	17.053	10	3.467	8.738	18.486	3.571
25	+ 1.519	+9.574	-10.687	+16.850	11	+ 3.490	+8.702	-18.539	+ 3.222
26	1.616	9.547	10.961	16.641	12	3.502	8.671	18.587	2.872
27	1.704	9.502	11.231	16.426	13	3.506	8.651	18.630	2.522
28	1.775	9.447	11.497	16.206	14	3.507	8.647	18.667	2.171
29	1.828	9.391	11.759	15.980	15	3.512	8.659	18.699	1.820
30	+ 1.863	+9.344	-12.017	+15.750	16	+ 3.528	+8.684	-18.726	+ 1.468
31	1.888	9.309	12.270	15.514	17	3.559	8.716	18.747	1.116
Feb. 1	1.908	9.290	12.520	15.274	18	3.607	8.745	18.763	0.763
2	1.932	9.283	12.765	15.029	19	3.668	8.766	18.774	0.410
3	1.962	9.286	13.006	14.779	20	3.735	8.772	18.779	+ 0.056
4	+ 2.003	+9.293	-13.242	+14.525	21	+ 3.801	+8.760	-18.779	- 0.298
5	2.052	9.300	13.474	14.267	22	3.858	8.734	18.773	0.652
6	2.111	9.303	13.701	14.005	23	3.901	8.701	18.761	1.006
7	2.176	9.298	13.924	13.739	24	3.927	8.669	18.743	1.361
8	2.245	9.281	14.142	13.469	25	3.940	8.645	18.720	1.714
9	+ 2.312	+9.254	-14.356	+13.196	26	+ 3.943	+8.635	-18.690	- 2.068
10	2.374	9.216	14.566	12.919	27	3.944	8.640	18.655	2.420
11	2.428	9.170	14.771	12.638	28	3.948	8.659	18.613	2.771
12	2.470	9.121	14.972	12.354	29	3.960	8.688	18.566	3.121
13	2.500	9.072	15.168	12.066	30	3.984	8.722	18.512	3.470
14	+ 2.519	+9.032	-15.359	+11.775	31	+ 4.020	+8.756	-18.454	- 3.817
15	+ 2.532	+9.006	-15.546	+11.481	Apr. 1	+ 4.064	+8.784	-18.389	- 4.163

E can be taken from pages 266-280 without appreciable error.

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Apr. 1	+ 4.064	+ 8.784	- 18.389	- 4.163	May 17	+ 6.133	+ 9.399	- 10.392	- 17.039
2	4.116	8.804	18.319	4.507	18	6.177	9.381	10.129	17.227
3	4.170	8.814	18.244	4.848	19	6.209	9.375	9.864	17.412
4	4.223	8.813	18.163	5.188	20	6.235	9.382	9.595	17.591
5	4.271	8.802	18.077	5.526	21	6.261	9.403	9.323	17.765
6	+ 4.311	+ 8.785	- 17.986	- 5.862	22	+ 6.292	+ 9.435	- 9.048	- 17.934
7	4.342	8.765	17.890	6.195	23	6.333	9.475	8.771	18.098
8	4.361	8.748	17.790	6.526	24	6.384	9.518	8.490	18.256
9	4.371	8.740	17.684	6.855	25	6.448	9.557	8.208	18.409
10	4.376	8.745	17.574	7.182	26	6.520	9.591	7.923	18.557
11	+ 4.383	+ 8.767	- 17.459	- 7.506	27	+ 6.599	+ 9.614	- 7.636	- 18.699
12	4.398	8.804	17.340	7.828	28	6.679	9.626	7.347	18.835
13	4.429	8.852	17.216	8.148	29	6.758	9.626	7.055	18.966
14	4.478	8.902	17.087	8.465	30	6.831	9.616	6.763	19.091
15	4.544	8.942	16.954	8.780	31	6.895	9.600	6.468	19.211
16	+ 4.619	+ 8.968	- 16.816	- 9.093	June 1	+ 6.948	+ 9.581	- 6.172	- 19.325
17	4.695	8.976	16.673	9.404	2	6.992	9.566	5.875	19.432
18	4.764	8.968	16.525	9.712	3	7.028	9.558	5.576	19.535
19	4.818	8.951	16.373	10.017	4	7.059	9.562	5.277	19.632
20	4.858	8.933	16.215	10.320	5	7.092	9.580	4.976	19.723
21	+ 4.883	+ 8.919	- 16.053	- 10.620	6	+ 7.134	+ 9.612	- 4.675	- 19.809
22	4.897	8.917	15.886	10.917	7	7.190	9.655	4.373	19.890
23	4.908	8.930	15.714	11.211	8	7.266	9.699	4.070	19.965
24	4.920	8.957	15.537	11.502	9	7.362	9.734	3.767	20.035
25	4.940	8.995	15.355	11.789	10	7.468	9.751	3.462	20.100
26	+ 4.970	+ 9.040	- 15.169	- 12.072	11	+ 7.575	+ 9.747	- 3.156	- 20.161
27	5.011	9.085	14.978	12.351	12	7.672	9.724	2.850	20.216
28	5.064	9.127	14.782	12.627	13	7.753	9.691	2.543	20.266
29	5.125	9.160	14.583	12.898	14	7.814	9.657	2.234	20.311
30	5.191	9.184	14.379	13.165	15	7.860	9.633	1.925	20.350
May 1	+ 5.257	+ 9.197	- 14.171	- 13.428	16	+ 7.895	+ 9.621	- 1.614	- 20.384
2	5.320	9.198	13.959	13.686	17	7.928	9.623	1.303	20.411
3	5.377	9.192	13.744	13.940	18	7.965	9.638	0.991	20.434
4	5.424	9.181	13.525	14.189	19	8.010	9.663	0.678	20.450
5	5.461	9.170	13.303	14.434	20	8.064	9.690	0.365	20.461
6	+ 5.488	+ 9.165	- 13.077	- 14.675	21	+ 8.131	+ 9.718	- 0.052	- 20.466
7	5.509	9.170	12.848	14.911	22	8.206	9.739	+ 0.261	20.465
8	5.528	9.189	12.616	15.143	23	8.288	9.751	0.574	20.458
9	5.552	9.224	12.381	15.370	24	8.373	9.752	0.887	20.445
10	5.589	9.274	12.143	15.593	25	8.457	9.740	1.200	20.426
11	+ 5.645	+ 9.329	- 11.902	- 15.812	26	+ 8.537	+ 9.719	+ 1.512	- 20.401
12	5.719	9.379	11.658	16.027	27	8.608	9.688	1.824	20.370
13	5.810	9.415	11.411	16.238	28	8.669	9.655	2.135	20.332
14	5.905	9.433	11.161	16.445	29	8.718	9.622	2.446	20.290
15	5.996	9.432	10.908	16.647	30	8.759	9.595	2.755	20.241
16	+ 6.073	+ 9.418	- 10.652	- 16.845	July 1	+ 8.793	+ 9.577	+ 3.063	- 20.187
17	+ 6.133	+ 9.399	- 10.392	- 17.039	2	+ 8.825	+ 9.572	+ 3.370	- 20.126

E can be taken from pages 266-280 without appreciable error.

BESSELIAN DAY NUMBERS, 1960

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
July 2	-11.217	+9.572	+ 3.374	-20.125	Aug. 17	- 8.676	+8.927	+15.227	-11.976
3	11.179	9.582	3.680	20.060	18	8.612	8.908	15.410	11.696
4	11.130	9.603	3.984	19.989	19	8.551	8.879	15.589	11.413
5	11.065	9.630	4.287	19.913	20	8.497	8.839	15.764	11.126
6	10.981	9.654	4.588	19.832	21	8.452	8.794	15.934	10.835
7	-10.881	+9.666	+ 4.887	-19.746	22	- 8.418	+8.747	+16.100	-10.541
8	10.774	9.657	5.185	19.655	23	8.395	8.704	16.261	10.244
9	10.672	9.627	5.482	19.559	24	8.381	8.669	16.417	9.944
10	10.583	9.581	5.777	19.458	25	8.373	8.645	16.568	9.641
11	10.514	9.529	6.072	19.352	26	8.364	8.636	16.714	9.334
12	-10.464	+9.482	+ 6.365	-19.241	27	- 8.350	+8.640	+16.854	- 9.025
13	10.428	9.447	6.657	19.125	28	8.323	8.655	16.990	8.714
14	10.398	9.428	6.947	19.004	29	8.282	8.672	17.121	8.400
15	10.368	9.423	7.236	18.877	30	8.224	8.686	17.247	8.084
16	10.333	9.430	7.523	18.745	31	8.155	8.688	17.367	7.766
17	-10.287	+9.442	+ 7.809	-18.607	Sept. 1	- 8.081	+8.674	+17.483	- 7.446
18	10.230	9.455	8.093	18.465	2	8.008	8.641	17.594	7.125
19	10.165	9.464	8.374	18.316	3	7.948	8.595	17.700	6.801
20	10.091	9.466	8.654	18.163	4	7.907	8.544	17.802	6.476
21	10.014	9.457	8.931	18.004	5	7.883	8.496	17.899	6.150
22	- 9.935	+9.436	+ 9.206	-17.839	6	- 7.874	+8.462	+17.991	- 5.821
23	9.862	9.404	9.478	17.670	7	7.870	8.445	18.079	5.491
24	9.797	9.364	9.747	17.495	8	7.866	8.445	18.162	5.159
25	9.741	9.318	10.014	17.315	9	7.853	8.458	18.240	4.825
26	9.697	9.272	10.278	17.130	10	7.831	8.477	18.314	4.489
27	- 9.663	+9.229	+10.538	-16.939	11	- 7.797	+8.497	+18.382	- 4.151
28	9.637	9.197	10.796	16.744	12	7.754	8.513	18.446	3.812
29	9.615	9.177	11.050	16.544	13	7.703	8.520	18.504	3.471
30	9.591	9.170	11.301	16.340	14	7.650	8.516	18.557	3.129
31	9.559	9.176	11.548	16.131	15	7.597	8.503	18.605	2.785
Aug. 1	- 9.513	+9.189	+11.792	-15.918	16	- 7.549	+8.479	+18.647	- 2.440
2	9.450	9.204	12.032	15.700	17	7.509	8.448	18.684	2.093
3	9.372	9.211	12.269	15.479	18	7.480	8.414	18.715	1.746
4	8.282	9.203	12.502	15.253	19	7.461	8.381	18.740	1.398
5	9.190	9.174	12.732	15.024	20	7.453	8.356	18.760	1.048
6	- 9.107	+9.128	+12.959	-14.792	21	- 7.451	+8.341	+18.774	- 0.699
7	9.040	9.071	13.182	14.555	21	7.451	8.342	18.782	- 0.348
8	8.994	9.012	13.402	14.315	22	7.446	8.356	18.785	+ 0.002
9	8.964	8.963	13.619	14.071	23	7.429	8.384	18.781	0.352
10	8.946	8.929	13.833	13.823	24	7.398	8.417	18.772	0.703
11	- 8.931	+8.912	+14.043	-13.571	25	- 7.351	+8.447	+18.757	+ 1.052
12	8.910	8.909	14.250	13.315	26	7.290	8.469	18.736	1.402
13	8.883	8.915	14.453	13.056	27	7.222	8.475	18.710	1.751
14	8.844	8.925	14.652	12.792	28	7.155	8.464	18.678	2.099
15	8.796	8.934	14.847	12.524	29	7.096	8.441	18.641	2.446
16	- 8.738	+8.935	+15.039	-12.252	30	- 7.052	+8.407	+18.599	+ 2.792
17	- 8.676	+8.927	+15.227	-11.976	Oct. 1	- 7.025	+8.376	+18.552	+ 3.138

E can be taken from pages 266-280 without appreciable error.

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Oct. 1	- 7.025	+8.376	+18.552	+ 3.138	Nov. 16	- 5.257	+8.966	+10.911	+16.679
2	7.012	8.352	18.499	3.482	17	5.214	9.013	10.640	16.887
3	7.009	8.344	18.442	3.825	18	5.154	9.066	10.365	17.089
4	7.007	8.353	18.379	4.168	19	5.074	9.113	10.087	17.285
5	6.999	8.377	18.312	4.509	20	4.980	9.149	9.805	17.477
6	- 6.982	+8.412	+18.239	+ 4.850	21	- 4.880	+9.164	+ 9.520	+17.662
7	6.952	8.448	18.161	5.189	22	4.784	9.160	9.232	17.841
8	6.911	8.484	18.078	5.528	23	4.700	9.144	8.941	18.014
9	6.861	8.513	17.989	5.866	24	4.633	9.119	8.648	18.182
10	6.805	8.530	17.896	6.202	25	4.584	9.099	8.351	18.343
11	- 6.748	+8.538	+17.796	+ 6.537	26	- 4.548	+9.089	+ 8.053	+18.499
12	6.694	8.535	17.692	6.871	27	4.517	9.094	7.753	18.649
13	6.647	8.523	17.582	7.203	28	4.485	9.114	7.450	18.793
14	6.609	8.506	17.467	7.534	29	4.447	9.147	7.146	18.932
15	6.581	8.489	17.346	7.863	30	4.398	9.186	6.839	19.065
16	- 6.563	+8.476	+17.220	+ 8.189	Dec. 1	- 4.336	+9.227	+ 6.531	+19.192
17	6.553	8.472	17.088	8.514	2	4.264	9.264	6.221	19.314
18	6.547	8.482	16.950	8.837	3	4.182	9.293	5.909	19.431
19	6.537	8.507	16.807	9.157	4	4.096	9.309	5.595	19.542
20	6.519	8.544	16.659	9.474	5	4.009	9.314	5.279	19.647
21	- 6.486	+8.593	+16.505	+ 9.789	6	- 3.926	+9.307	+ 4.961	+19.746
22	6.433	8.642	16.346	10.100	7	3.851	9.291	4.641	19.839
23	6.367	8.682	16.181	10.408	8	3.785	9.270	4.320	19.927
24	6.289	8.709	16.012	10.712	9	3.730	9.248	3.997	20.008
25	6.209	8.717	15.837	11.013	10	3.684	9.229	3.672	20.084
26	- 6.137	+8.709	+15.658	+11.311	11	- 3.645	+9.220	+ 3.346	+20.153
27	6.077	8.692	15.474	11.605	12	3.609	9.222	3.018	20.216
28	6.035	8.672	15.286	11.895	13	3.572	9.237	2.689	20.273
29	6.006	8.658	15.093	12.182	14	3.525	9.264	2.359	20.324
30	5.989	8.656	14.896	12.464	15	3.463	9.300	2.027	20.368
31	- 5.975	+8.671	+14.695	+12.744	16	- 3.382	+9.337	+ 1.695	+20.405
Nov. 1	5.958	8.700	14.489	13.019	17	3.284	9.365	1.361	20.435
2	5.933	8.742	14.280	13.291	18	3.173	9.377	1.027	20.458
3	5.894	8.789	14.066	13.559	19	3.061	9.367	0.692	20.475
4	5.844	8.836	13.848	13.823	20	2.958	9.337	0.358	20.484
5	- 5.782	+8.877	+13.626	+14.083	21	- 2.873	+9.296	+ 0.023	+20.487
6	5.714	8.909	13.400	14.340	22	2.807	9.255	- 0.311	20.483
7	5.642	8.929	13.170	14.593	23	2.758	9.222	0.644	20.472
8	5.571	8.938	12.935	14.843	24	2.720	9.203	0.977	20.454
9	5.506	8.936	12.697	15.088	25	2.683	9.200	1.309	20.430
10	- 5.448	+8.928	+12.454	+15.329	26	- 2.641	+9.211	- 1.641	+20.400
11	5.400	8.916	12.207	15.566	27	2.591	9.231	1.972	20.364
12	5.363	8.907	11.956	15.798	28	2.530	9.254	2.301	20.322
13	5.334	8.903	11.701	16.026	29	2.458	9.274	2.630	20.273
14	5.309	8.911	11.441	16.248	30	2.376	9.288	2.958	20.219
15	- 5.287	+8.931	+11.178	+16.466	31	- 2.288	+9.291	- 3.285	+20.158
16	- 5.257	+8.966	+10.911	+16.679	32	- 2.199	+9.280	- 3.611	+20.091

E can be taken from pages 266-280 without appreciable error.

FOR 0^h EPHEMERIS TIME

R.A.		0 ^h 1 ^h 2 ^h			3 ^h 4 ^h 5 ^h			6 ^h	7 ^h 8 ^h 9 ^h	10 ^h 11 ^h 12 ^h				
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h 20 ^h 21 ^h	22 ^h 23 ^h 24 ^h				
J (0 ^s .00001)														
Jan.	- 3	+ 5	+ 7	+ 7	+ 5	+ 2	- 2	- 5	- 7	- 7	- 5	- 2	+ 2	+ 5
	7	+ 3	+ 6	+ 7	+ 6	+ 4	0	- 3	- 6	- 7	- 6	- 4	0	+ 3
	17	+ 1	+ 4	+ 6	+ 6	+ 5	+ 2	- 1	- 4	- 6	- 6	- 5	- 2	+ 1
	27	- 1	+ 2	+ 4	+ 5	+ 5	+ 3	+ 1	- 2	- 4	- 5	- 5	- 3	- 1
Feb.	6	- 2	0	+ 2	+ 4	+ 5	+ 4	+ 2	0	- 2	- 4	- 5	- 4	- 2
	16	- 3	- 1	+ 1	+ 2	+ 4	+ 4	+ 3	+ 1	- 1	- 2	- 4	- 4	- 3
	26	- 3	- 2	- 1	+ 1	+ 2	+ 3	+ 3	+ 2	+ 1	- 1	- 2	- 3	- 3
Mar.	7	- 2	- 2	- 2	0	+ 1	+ 2	+ 2	+ 2	+ 2	0	- 1	- 2	- 2
	17	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1	0	- 1	- 2
	27	- 1	- 1	- 2	- 2	- 1	0	+ 1	+ 1	+ 2	+ 2	+ 1	0	- 1
Apr.	6	0	0	- 1	- 1	- 1	- 1	0	0	+ 1	+ 1	+ 1	+ 1	0
	16	+ 1	+ 1	0	- 1	- 1	- 1	- 1	- 1	0	+ 1	+ 1	+ 1	+ 1
	26	+ 1	+ 1	+ 1	0	- 1	- 1	- 1	- 1	- 1	0	+ 1	+ 1	+ 1
May	6	+ 1	+ 2	+ 2	+ 1	0	0	- 1	- 2	- 2	- 1	0	0	+ 1
	16	0	+ 1	+ 2	+ 2	+ 1	+ 1	0	- 1	- 2	- 2	- 1	- 1	0
	26	- 1	+ 1	+ 2	+ 2	+ 2	+ 2	+ 1	- 1	- 2	- 2	- 2	- 2	- 1
June	5	- 2	0	+ 1	+ 2	+ 3	+ 3	+ 2	0	- 1	- 2	- 3	- 3	- 2
	15	- 3	- 2	0	+ 2	+ 3	+ 3	+ 3	+ 2	0	- 2	- 3	- 3	- 3
	25	- 4	- 3	- 2	0	+ 2	+ 4	+ 4	+ 3	+ 2	0	- 2	- 4	- 4
July	5	- 5	- 5	- 3	- 1	+ 1	+ 4	+ 5	+ 5	+ 3	+ 1	- 1	- 4	- 5
June	25	-11	- 2	+ 7	+15	+18	+17	+11	+ 2	- 7	-15	-18	-17	-11
July	5	-14	- 6	+ 4	+12	+18	+18	+14	+ 6	- 4	-12	-18	-18	-14
	15	-16	- 9	0	+ 9	+16	+18	+16	+ 9	0	- 9	-16	-18	-16
	25	-17	-12	- 3	+ 6	+14	+18	+17	+12	+ 3	- 6	-14	-18	-17
Aug.	4	-17	-14	- 7	+ 2	+11	+16	+17	+14	+ 7	- 2	-11	-16	-17
	14	-17	-15	- 9	- 1	+ 7	+13	+17	+15	+ 9	+ 1	- 7	-13	-17
	24	-15	-15	-12	- 5	+ 3	+10	+15	+15	+12	+ 5	- 3	-10	-15
Sept.	3	-13	-14	-13	- 8	0	+ 7	+13	+14	+13	+ 8	0	- 7	-13
	13	-10	-13	-13	-10	- 4	+ 4	+10	+13	+13	+10	+ 4	- 4	-10
	23	- 6	-11	-13	-11	- 6	0	+ 6	+11	+13	+11	+ 6	0	- 6
Oct.	3	- 3	- 8	-11	-11	- 8	- 3	+ 3	+ 8	+11	+11	+ 8	+ 3	- 3
	13	0	- 5	-10	-11	-10	- 6	0	+ 5	+10	+11	+10	+ 6	0
	23	+ 3	- 2	- 7	-10	-10	- 7	- 3	+ 2	+ 7	+10	+10	+ 7	+ 3
Nov.	2	+ 5	+ 1	- 4	- 8	- 9	- 9	- 5	- 1	+ 4	+ 8	+ 9	+ 9	+ 5
	12	+ 7	+ 3	- 1	- 5	- 8	- 9	- 7	- 3	+ 1	+ 5	+ 8	+ 9	+ 7
	22	+ 8	+ 5	+ 1	- 3	- 6	- 8	- 8	- 5	- 1	+ 3	+ 6	+ 8	+ 8
Dec.	2	+ 8	+ 6	+ 3	0	- 4	- 7	- 8	- 6	- 3	0	+ 4	+ 7	+ 8
	12	+ 7	+ 7	+ 5	+ 2	- 2	- 5	- 7	- 7	- 5	- 2	+ 2	+ 5	+ 7
	22	+ 5	+ 6	+ 6	+ 4	+ 1	- 3	- 5	- 6	- 6	- 4	- 1	+ 3	+ 5
	32	+ 3	+ 5	+ 6	+ 5	+ 2	- 1	- 3	- 5	- 6	- 5	- 2	+ 1	+ 3

The quantity J is given in this table in units of 0^s.00001, and is to be multiplied by $\tan^2 \delta$ to give the second-order correction in the calculation of the apparent right ascension of a star.

The complete formula is :

$$\alpha = \alpha_0 + \tau\mu_\alpha + Aa + Bb + Cc + Dd + E + J \tan^2 \delta$$

FOR NORTHERN DECLINATIONS ONLY

FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J' (0".0001)														
Jan.	- 3	- 2	- 4	- 7	-10	-11	-11	-10	- 7	- 4	- 2	0	0	- 2
	7	- 1	- 2	- 5	- 7	-10	-10	-10	- 8	- 6	- 3	- 1	0	- 1
	17	0	- 1	- 3	- 5	- 8	- 9	- 9	- 8	- 6	- 4	- 2	0	0
	27	0	0	- 1	- 3	- 5	- 7	- 8	- 8	- 7	- 5	- 3	- 1	0
Feb.	6	0	0	0	- 2	- 3	- 5	- 6	- 7	- 6	- 5	- 3	- 2	0
	16	- 1	0	0	- 1	- 2	- 3	- 5	- 6	- 6	- 5	- 4	- 2	- 1
	26	- 2	- 1	0	0	- 1	- 2	- 3	- 4	- 5	- 5	- 4	- 3	- 2
Mar.	7	- 2	- 1	0	0	0	- 1	- 2	- 3	- 3	- 4	- 4	- 3	- 2
	17	- 2	- 2	- 1	0	0	0	- 1	- 1	- 2	- 3	- 3	- 3	- 2
	27	- 2	- 2	- 1	- 1	0	0	0	0	- 1	- 2	- 2	- 2	- 2
Apr.	6	- 2	- 2	- 2	- 1	- 1	0	0	0	0	- 1	- 1	- 2	- 2
	16	- 2	- 2	- 2	- 2	- 1	- 1	0	0	0	0	- 1	- 1	- 2
	26	- 1	- 1	- 2	- 2	- 2	- 2	- 1	- 1	0	0	0	0	- 1
May	6	0	- 1	- 2	- 2	- 2	- 2	- 2	- 2	- 1	0	0	0	0
	16	0	0	- 1	- 2	- 2	- 3	- 3	- 2	- 2	- 1	0	0	0
	26	0	0	- 1	- 1	- 2	- 3	- 3	- 3	- 3	- 2	- 1	- 1	0
June	5	0	0	0	- 1	- 2	- 3	- 4	- 4	- 4	- 4	- 3	- 1	0
	15	- 1	0	0	0	- 1	- 2	- 4	- 5	- 5	- 5	- 4	- 3	- 1
	25	- 3	- 1	0	0	- 1	- 2	- 3	- 5	- 6	- 6	- 6	- 4	- 3
July	5	- 5	- 3	- 1	0	0	- 1	- 3	- 5	- 7	- 7	- 7	- 6	- 5
June	25	- 3	0	- 1	- 5	-12	-19	-25	-29	-27	-22	-16	- 9	- 3
July	5	- 5	- 1	0	- 4	-10	-17	-23	-27	-28	-24	-18	-11	- 5
	15	- 7	- 2	0	- 2	- 7	-14	-21	-26	-28	-26	-20	-14	- 7
	25	- 9	- 3	0	- 1	- 5	-11	-18	-24	-27	-26	-22	-16	- 9
Aug.	4	-11	- 5	- 1	0	- 3	- 8	-15	-21	-25	-26	-23	-18	-11
	14	-14	- 7	- 2	0	- 1	- 5	-11	-18	-23	-25	-24	-20	-14
	24	-15	- 9	- 4	- 1	0	- 4	- 8	-14	-20	-23	-23	-20	-15
Sept.	3	-17	-11	- 6	- 2	0	- 1	- 5	-11	-16	-21	-22	-21	-17
	13	-18	-13	- 8	- 3	0	0	- 3	- 8	-13	-18	-20	-20	-18
	23	-18	-14	-10	- 5	- 1	0	- 1	- 5	-10	-14	-18	-19	-18
Oct.	3	-17	-15	-11	- 7	- 3	0	0	- 3	- 7	-11	-15	-17	-17
	13	-17	-16	-13	- 8	- 4	- 1	0	- 1	- 4	- 8	-12	-16	-17
	23	-15	-15	-13	-10	- 6	- 2	0	0	- 2	- 6	-10	-13	-15
Nov.	2	-13	-14	-14	-11	- 8	- 4	- 1	0	- 1	- 3	- 7	-10	-13
	12	-11	-13	-13	-12	- 9	- 6	- 3	0	0	- 1	- 4	- 8	-11
	22	- 8	-11	-12	-12	-10	- 7	- 4	- 1	0	0	- 2	- 5	- 8
Dec.	2	- 6	- 9	-11	-11	-10	- 8	- 5	- 3	- 1	0	- 1	- 3	- 6
	12	- 4	- 6	- 9	-10	-10	- 9	- 7	- 4	- 2	0	0	- 1	- 4
	22	- 2	- 4	- 7	- 9	-10	- 9	- 8	- 5	- 3	- 1	0	0	- 2
	32	- 1	- 3	- 5	- 7	- 8	- 9	- 8	- 6	- 4	- 2	0	0	- 1

The quantity J' is given in this table in units of 0".0001, and is to be multiplied by $\tan \delta$ to give the second-order correction in the calculation of the apparent declination of a star.

The complete formula is :

$$\delta = \delta_0 + \tau\mu_\delta + Aa' + Bb' + Cc' + Dd' + J' \tan \delta$$

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
2 Cet	4.6	A0	0 01 41.5	-17 33 31	ν And	4.2	G0	1 34 26.4	+41 12 22
33 Psc	4.7	K0	0 03 17.2	- 5 55 52	51 And	3.8	K0	1 35 31.5	+48 25 35
α And	2.1	A0 _p	0 06 18.9	+28 52 11	α Eri	0.6	B5	1 36 13.6	-57 26 22
β Cas	2.4	F5	0 07 01.8	+58 55 45	ν Psc	4.7	K0	1 39 20.8	+ 5 17 09
ε Phe	3.9	K0	0 07 23.2	-45 58 05	φ Per	4.2	B0 _p	1 41 08.4	+50 29 17
γ Peg	2.9	B2	0 11 10.3	+14 57 40	τ Cet	3.6	K0	1 42 12.5	-16 08 51
7 Cet	4.7	M1	0 12 36.5	-19 09 16	ο Psc	4.5	K0	1 43 16.7	+ 8 57 26
θ And	4.4	A2	0 14 59.7	+38 27 35	α U Mi	2.1	F8	1 55 41.5	+89 04 41
σ And	4.5	A2	0 16 13.9	+36 33 49	ξ Cet	3.9	K0	1 49 29.1	-10 31 55
ι Cet	3.7	K0	0 17 23.3	- 9 02 44	α Tri	3.6	F5	1 50 47.7	+29 23 05
ζ Tuc	4.3	F8	0 18 00.0	-65 06 35	ε Cas	3.4	B3	1 51 29.7	+63 28 27
β Hyi	2.9	G0	0 23 40.7	-77 28 46	γ Ari	4.7	A0 _p	1 51 19.8	+19 05 54
κ Phe	3.9	A3	0 24 14.4	-43 54 06	ψ Phe	4.4	M3	1 52 02.6	-46 29 53
α Phe	2.4	K0	0 24 18.6	-42 31 23	β Ari	2.7	A5	1 52 25.5	+20 36 48
β Tuc	4.5	A2	0 29 44.0	-63 11 09	η ² Hyi	4.7	K0	1 53 55.1	-67 50 37
κ Cas	4.2	B0	0 30 42.5	+62 42 41	χ Eri	3.7	G5	1 54 24.1	-51 48 27
ξ Cas	3.7	B3	0 34 43.8	+53 40 37	-47°597	4.7	G5	1 55 34.9	-47 34 48
π And	4.5	B3	0 34 44.2	+33 29 58	α Hyi	3.0	F0	1 57 30.6	-61 45 50
ε And	4.5	G5	0 36 26.1	+29 05 42	ν Cet	4.2	M0	1 58 07.2	-21 16 15
δ And	3.5	K2	0 37 10.9	+30 38 32	48 Cas	4.6	A3	1 58 38.0	+70 42 52
α Cas	2.3	K0	0 38 13.4	+56 19 06	50 Cas	4.1	A2	1 59 58.6	+72 13 45
μ Phe	4.6	K0	0 39 26.3	-46 18 16	α Psc	4.3	A2 _p	1 59 58.4	+ 2 34 17
β Cet	2.2	K0	0 41 34.9	-18 12 21	γ ¹ And	2.3	K0	2 01 26.0	+42 08 19
η Phe	4.5	A0	0 41 33.7	-57 40 56	ν For	4.7	A0 _p	2 02 41.9	-29 29 17
ο Cas	4.7	B2	0 42 29.1	+48 03 57	α Ari	2.2	K2	2 04 54.8	+23 16 27
ζ And	4.3	K0	0 45 12.8	+24 03 00	β Tri	3.1	A5	2 07 09.3	+34 47 56
η Cas	3.6	F8	0 46 39.8	+57 36 14	ξ ¹ Cet	4.5	G5	2 10 52.6	+ 8 39 36
δ Psc	4.5	K5	0 46 36.2	+ 7 22 04	γ Tri	4.1	A0	2 14 55.7	+33 39 48
ν And	4.4	B3	0 47 35.9	+40 51 41	φ Eri	3.8	B8	2 15 04.8	-51 41 48
γ Cas	Var.	B0 _p	0 54 16.6	+60 30 02	ο Cet	2-10	M5 _e	2 17 19.4	- 3 09 30
μ And	3.9	A2	0 54 31.5	+38 16 58	δ Hyi	4.3	A2	2 21 01.9	-68 50 28
η And	4.6	G5	0 55 03.9	+23 12 08	ι Cas	4.6	A5 _p	2 25 44.4	+67 13 27
α Scl	4.4	B5	0 56 40.7	-29 34 24	κ Eri	4.4	B5	2 25 31.1	-47 52 58
ε Psc	4.4	K0	1 00 51.8	+ 7 40 31	ξ ² Cet	4.3	A0	2 26 01.7	+ 8 16 54
43 H. Cep	4.5	K0	1 02 53.8	+86 02 37	δ Cet	4.0	B2	2 37 25.8	+ 0 09 25
β Phe	3.3	K0	1 04 18.1	-46 55 57	s Eri	4.5	A2	2 38 16.4	-43 03 46
η Cet	3.6	K0	1 06 34.6	-10 23 38	ι Eri	4.1	K0	2 39 05.3	-40 01 33
ξ Phe	4.1	B8	1 06 42.4	-55 27 34	ε Hyi	4.3	B9	2 38 58.0	-68 26 17
φ And	4.3	B8	1 07 10.2	+47 01 45	35 Ari	4.6	B3	2 41 05.9	+27 32 17
β And	2.4	M0	1 07 29.1	+35 24 32	γ Cet	3.6	A2	2 41 13.5	+ 3 04 06
θ Cas	4.5	A5	1 08 39.1	+54 56 16	θ Per	4.2	F8	2 41 27.3	+49 03 38
τ Psc	4.7	K0	1 09 27.0	+29 52 40	π Cet	4.4	B5	2 42 13.0	-14 01 38
φ Psc	4.6	K0	1 11 34.2	+24 22 20	μ Cet	4.4	F0	2 42 46.6	+ 9 56 47
ν Psc	4.7	A2	1 17 15.7	+27 03 16	1 Eri	4.6	F5	2 43 14.1	-18 44 27
θ Cet	3.8	K0	1 22 01.3	- 8 23 21	39 Ari	4.6	K0	2 45 31.2	+29 04 56
δ Cas	2.8	A5	1 23 10.8	+60 01 41	β For	4.5	K0	2 47 25.0	-32 34 23
γ Phe	3.4	K5	1 26 37.8	-43 31 22	η Per	3.9	K0	2 47 45.8	+55 43 52
η Psc	3.7	G5	1 29 20.3	+15 08 25	41 Ari	3.7	B8	2 47 37.4	+27 05 49
δ Phe	4.0	K0	1 29 35.3	-49 16 48	16 Per	4.3	F0	2 48 03.0	+38 09 19

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
17 Per	4.7	K5	2 49 02.6	+34 53 47	γ Hyi	3.2	M0	3 47 50.3	-74 21 43
τ Per	4.1	G0, A5	2 51 24.5	+52 36 01	ζ Per	2.9	B1	3 51 36.7	+31 45 59
ν Hyi	4.7	K2	2 50 42.5	-75 13 49	ε Per	3.0	B1	3 55 09.8	+39 53 46
η Eri	4.0	K0	2 54 28.3	- 9 03 23	γ Eri	3.2	K5	3 56 09.7	-13 37 16
π Per	4.6	A2	2 56 11.7	+39 30 14	ξ Per	4.0	Oe5	3 56 21.8	+35 40 40
ε Ari	4.6	A2	2 56 55.2	+21 10 54	36 Eri	4.7	A0 _p	3 58 13.1	-24 07 43
θ ¹ Eri	3.4	A2	2 56 44.6	-40 27 51	λ Tau	3.9	B3	3 58 27.7	+12 22 44
λ Cet	4.7	B5	2 57 34.1	+ 8 44 57	δ Ret	4.4	M0	3 58 06.5	-61 30 46
α Cet	2.8	M0	3 00 11.1	+ 3 56 02	γ Ret	4.5	M5	4 00 18.8	-62 16 15
τ ³ Eri	4.2	A3	3 00 37.6	-23 46 49	ν Tau	3.9	A0	4 01 01.5	+ 5 52 47
γ Per	3.1	F5, A3	3 01 53.1	+53 21 05	37 Tau	4.5	K0	4 02 19.6	+21 58 27
ρ Per	3-4	M3	3 02 36.3	+38 41 12	λ Per	4.3	A0	4 03 35.7	+50 14 41
β Per	2-3	B8	3 05 33.5	+40 48 11	48 Per	4.0	B3 _p	4 05 44.9	+47 36 28
ι Per	4.2	G0	3 06 10.1	+49 27 44	o ¹ Eri	4.1	F2	4 09 54.7	- 6 56 26
κ Per	4.0	K0	3 06 47.3	+44 42 26	μ Per	4.3	G0	4 11 57.1	+48 18 34
δ Ari	4.5	K0	3 09 20.2	+19 34 36	α Hor	3.8	K0	4 12 40.5	-42 23 32
α For	3.9	F8	3 10 22.2	-29 08 38	μ Tau	4.3	B3	4 13 21.6	+ 8 47 37
16 Eri	3.9	M3	3 17 44.2	-21 54 09	40 Eri	4.5	G5	4 13 25.8	- 7 42 50
+28°516	4.7	K5	3 17 54.8	+28 54 17	α Ret	3.4	G5	4 13 54.3	-62 34 25
82 G. Eri	4.3	G5	3 18 19.9	-43 13 18	b Per	4.6	A2	4 15 13.6	+50 11 57
α Per	1.9	F5	3 21 27.3	+49 43 14	γ Dor	4.4	F5	4 14 58.6	-51 35 12
o Tau	3.8	G5	3 22 39.4	+ 8 53 22	ε Ret	4.4	K2	4 15 47.3	-59 23 52
ξ Tau	3.7	B8	3 24 59.9	+ 9 35 41	41 Eri	3.6	B9	4 16 22.8	-33 53 42
2 H. Cam	4.4	B9 _p	3 25 48.7	+59 48 10	γ Tau	3.9	K0	4 17 30.8	+15 31 57
34 Per	4.7	B5	3 26 29.8	+49 22 19	δ Tau	3.9	K0	4 20 37.5	+17 27 01
σ Per	4.5	K0	3 27 44.6	+47 51 32	43 Eri	4.1	K5	4 22 31.9	-34 06 31
5 Tau	4.3	K0	3 28 39.7	+12 48 03	κ Tau	4.4	A3	4 22 58.9	+22 12 14
ε Eri	3.8	K0	3 31 02.6	- 9 35 33	68 Tau	4.2	A2	4 23 10.3	+17 50 17
τ ⁵ Eri	4.3	B8	3 32 01.2	-21 45 57	ν Tau	4.4	A5	4 23 54.6	+22 43 28
ψ Per	4.3	B5 _p	3 33 38.2	+48 03 41	71 Tau	4.6	A5	4 24 03.8	+15 31 44
10 Tau	4.4	G5	3 34 49.7	+ 0 16 34	ε Tau	3.6	K0	4 26 16.7	+19 05 36
γ Eri	4.6	K0	3 35 39.4	-40 24 18	77 Tau	4.0	K0	4 26 17.2	+15 52 30
δ Per	3.1	B5	3 40 04.0	+47 39 41	θ ² Tau	3.6	F0	4 26 22.5	+15 47 01
δ Eri	3.7	K0	3 41 19.8	- 9 53 52	ρ Tau	4.7	A5	4 31 34.5	+14 45 43
h Eri	4.6	K2	3 41 21.0	-37 26 20	50 Eri	4.6	K0	4 31 56.4	-29 50 47
o Per	3.9	B1	3 41 48.3	+32 09 47	88 Tau	4.4	A3	4 33 27.3	+10 04 49
ν Per	3.9	F5	3 42 28.1	+42 27 14	α Dor	3.5	A0 _p	4 33 07.8	-55 07 38
17 Tau	3.8	B5 _p	3 42 29.7	+23 59 21	α Tau	1.1	K5	4 33 37.4	+16 25 50
19 Tau	4.4	B5	3 42 49.3	+24 20 36	58 Per	4.5	K0, A3	4 33 54.7	+41 11 04
20 Tau	4.0	B5	3 43 26.5	+24 14 39	ν Eri	3.9	K0	4 33 59.6	-30 38 35
23 Tau	4.2	B5	3 43 56.8	+23 49 31	ν Eri	4.1	B2	4 34 19.1	- 3 25 58
β Ret	3.8	K0	3 43 41.4	-64 55 57	90 Tau	4.3	A3	4 35 55.1	+12 25 56
π Eri	4.6	M2	3 44 14.9	-12 13 33	53 Eri	4.0	K0	4 36 20.8	-14 22 51
η Tau	3.0	B5 _p	3 45 06.1	+23 58 59	54 Eri	4.5	M4	4 38 41.4	-19 44 49
τ ⁶ Eri	4.3	F8	3 45 07.6	-23 22 00	α Cae	4.5	F2	4 39 16.3	-41 56 22
+65°369	4.7	M1	3 45 50.2	+65 24 17	τ Tau	4.3	B5	4 39 50.5	+22 52 55
γ Cam	4.7	A0	3 46 06.1	+71 12 42	μ Eri	4.2	B5	4 43 30.0	- 3 19 36
27 Tau	3.8	B8	3 46 46.7	+23 55 57	π ³ Ori	3.3	F8	4 47 40.0	+ 6 53 35
g Eri	4.2	K0	3 47 57.4	-36 19 14	2 Ori	4.3	A0	4 48 25.8	+ 8 49 59

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
π^4 Ori	3.8	B3	4 49 04.4	+ 5 32 18	40 Ori	4.4	K0	5 34 42.4	+ 9 16 14
α Cam	4.4	B0	4 50 03.6	+66 16 39	ζ Tau	3.0	B3p	5 35 15.2	+21 07 12
ω Eri	4.4	F0	4 50 55.6	- 5 31 05	σ Ori	3.8	B0	5 36 44.2	- 2 37 18
π^5 Ori	3.9	B3	4 52 09.9	+ 2 22 36	ω Ori	4.5	B3p	5 37 04.3	+ 4 06 01
7 Ori	4.7	A0	4 52 41.5	+10 05 19	α Col	2.7	B5p	5 38 12.0	-34 05 40
7 Cam	4.4	A2	4 54 04.4	+53 41 25	ζ Ori	2.0	B0	5 38 44.4	- 1 57 44
9 Ori	4.3	K0	4 54 07.2	+13 27 10	γ Lep	3.8	F8	5 42 47.7	-22 27 37
ι Aur	2.9	K2	4 54 23.1	+33 06 17	δ Dor	4.5	A5	5 44 42.0	-65 45 02
10 Ori	4.7	K0	4 56 28.4	+ 1 39 15	ζ Lep	3.7	A2	5 45 08.5	-14 50 08
ϵ Aur	3-4	F5p	4 59 05.6	+43 45 58	κ Ori	2.2	B0	5 45 51.5	- 9 40 57
β Cam	4.2	G0p	4 59 51.1	+60 23 11	τ Aur	4.6	K0	5 46 24.1	+39 10 10
ζ Aur	3.9	K0, B1	4 59 40.7	+41 01 10	β Pic	3.9	A3	5 46 20.2	-51 04 49
ι Tau	4.7	A5	5 00 42.1	+21 32 04	ν Aur	4.2	K0	5 48 43.0	+39 08 20
11 Ori	4.6	B9	5 02 16.9	+15 21 00	γ Pic	4.4	K0	5 49 05.9	-56 10 34
γ Cae	4.6	K0	5 02 58.0	-35 32 13	δ Lep	3.9	K0	5 49 36.0	-20 52 52
η Aur	3.3	B3	5 03 42.3	+41 10 57	β Col	3.2	K0	5 49 32.9	-35 46 57
ϵ Lep	3.3	K5	5 03 46.0	-22 25 25	136 Tau	4.5	A0	5 50 48.7	+27 36 17
β Eri	2.9	A3	5 05 52.9	- 5 08 12	χ Ori	4.6	F8	5 52 00.8	+20 16 14
λ Eri	4.3	B2	5 07 13.8	- 8 48 14	α Ori	0-1	M0	5 53 00.3	+ 7 24 04
ι Lep	4.5	B8	5 10 25.8	-11 54 57	-63°498	4.5	K0	5 53 47.6	-63 06 06
ρ Ori	4.6	K0	5 11 11.9	+ 2 48 54	η Lep	3.8	F0	5 54 34.9	-14 10 25
μ Lep	3.3	A0p	5 11 08.0	-16 15 06	δ Aur	3.9	K0	5 56 14.0	+54 17 02
κ Lep	4.5	B8	5 11 23.0	-12 59 15	γ Col	4.4	B3	5 56 07.1	-35 17 12
β Ori	0.3	B8p	5 12 36.9	- 8 14 47	β Aur	2.1	A0p	5 56 35.6	+44 56 44
α Aur	0.2	G0	5 13 43.8	+45 57 34	π Aur	4.6	M3	5 56 57.9	+45 56 07
τ Ori	3.7	B5	5 15 39.8	- 6 53 10	θ Aur	2.7	A0p	5 56 59.6	+37 12 42
λ Lep	4.3	B1	5 17 43.9	-13 13 00	-3°1256	4.7	K0	5 58 03.2	- 3 04 28
-21°1135	4.7	A0	5 18 44.4	-21 16 43	η Col	4.0	K0	5 57 55.2	-42 49 00
22 Ori	4.6	B3	5 19 43.1	- 0 25 14	μ Ori	4.2	A2	6 00 10.9	+ 9 38 56
29 Ori	4.2	K0	5 22 01.1	- 7 50 36	62 Ori	4.7	B2p	6 01 32.6	+20 08 28
η Ori	3.4	B1	5 22 27.9	- 2 25 57	1 Gem	4.3	G5	6 01 41.3	+23 16 02
25 Ori	4.7	B3p	5 22 40.2	+ 1 48 41	θ Lep	4.7	A0	6 04 20.7	-14 55 49
γ Ori	1.7	B2	5 22 59.1	+ 6 18 54	ν Ori	4.4	B2	6 05 17.2	+14 46 29
β Tau	1.8	B8	5 23 45.7	+28 34 32	ξ Ori	4.3	B3	6 09 39.9	+14 13 10
ψ Ori	4.7	B2	5 24 44.4	+ 3 03 45	η Gem	3-4	M0	6 12 27.8	+22 31 12
β Lep	3.0	G0	5 26 31.9	-20 47 24	κ Aur	4.4	K0	6 12 49.8	+29 30 53
32 Ori	4.3	B3	5 28 38.6	+ 5 55 09	5 Mon	4.1	K0	6 12 54.2	- 6 15 40
119 Tau	4.7	M2	5 29 52.0	+18 33 58	22 H. Cam	4.7	A0	6 14 26.5	+69 20 14
ϵ Col	3.9	K0	5 29 47.5	-35 29 56	κ Col	4.5	K0	6 15 07.6	-35 07 34
δ Ori	2.5	B0	5 29 57.7	- 0 19 38	2 Lyn	4.4	A0	6 16 05.7	+59 01 41
ν Ori	4.6	B3	5 29 59.7	- 7 19 46	ζ C Ma	3.1	B3	6 18 46.6	-30 02 40
α Lep	2.7	F0	5 30 57.9	-17 50 58	μ Gem	3.2	M0	6 20 32.4	+22 32 09
ϕ^1 Ori	4.5	B0	5 32 37.4	+ 9 27 51	δ Col	4.0	G5	6 20 39.0	-33 24 54
λ Ori	3.7	Oe5	5 32 56.0	+ 9 54 32	β C Ma	2.0	B1	6 20 56.3	-17 56 05
-6°1234	4.7	B1	5 33 05.3	- 6 01 38	ϵ Mon	4.5	A5	6 21 38.9	+ 4 36 53
42 Ori	4.6	B3	5 33 24.7	- 4 51 47	α Car	-0.9	F0	6 23 03.8	-52 40 24
ι Ori	2.9	Oe5	5 33 28.5	- 5 56 05	ν Gem	4.1	B5	6 26 35.3	+20 14 21
β Dor	4-6	F5p	5 33 16.5	-62 30 57	λ C Ma	4.5	B5	6 26 41.1	-32 33 14
ϵ Ori	1.7	B0	5 34 11.0	- 1 13 33	β Mon	4.6	B2e	6 26 52.6	- 7 00 21

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
4 C Ma	4.3	B1	6 30 11.3	-23 23 18	β C Mi	3.1	B8	7 24 58.9	+ 8 22 17
13 Mon	4.5	A0 _p	6 30 44.4	+ 7 21 50	γ C Mi	4.6	K0	7 25 59.1	+ 9 00 29
ξ C Ma	4.5	A0	6 33 22.7	-22 55 55	ρ Gem	4.2	F0	7 26 32.5	+31 51 56
N Car	4.4	A0	6 34 05.6	-52 56 32	σ Pup	3.3	K5	7 27 57.7	-43 13 11
ν C Ma	4.1	K0	6 34 56.3	-19 13 14	α Gem	1.6	A0	7 32 02.9	+31 58 39
γ Gem	1.9	A0	6 35 24.1	+16 26 06	108 G. Pup	4.5	F8	7 32 20.4	-22 12 31
8 C Ma	4.6	K0	6 36 07.8	-18 12 05	ν Gem	4.2	K5	7 33 27.6	+26 59 11
ν Pup	3.2	B8	6 36 32.2	-43 09 36	p Pup	4.5	B8	7 33 46.4	-28 16 48
S Mon	4.7	Oe5	6 38 46.5	+ 9 56 04	f Pup	4.6	B8	7 35 53.2	-34 52 39
ϵ Gem	3.2	G5	6 41 28.3	+25 10 21	m Pup	4.6	B8	7 36 38.1	-25 16 22
30 Gem	4.6	K0	6 41 44.0	+13 16 12	α C Mi	0.5	F5	7 37 12.5	+ 5 19 44
ξ Gem	3.4	F5	6 43 02.7	+12 56 25	k Pup	4.5	B8	7 37 10.9	-26 42 35
α C Ma	-1.6	A0	6 43 23.2	-16 39 36	α Mon	4.1	K0	7 39 20.2	- 9 27 24
18 Mon	4.7	K0	6 45 46.5	+ 2 27 27	σ Gem	4.3	K0	7 40 48.9	+28 58 55
α Pic	3.3	A5	6 47 46.9	-61 53 53	κ Gem	3.7	G5	7 42 02.1	+24 29 44
κ C Ma	3.8	B2 _p	6 48 20.8	-32 27 40	3 Pup	4.1	A2 _p	7 42 12.1	-28 51 30
τ Pup	2.8	K0	6 48 56.6	-50 33 59	β Gem	1.2	K0	7 42 52.3	+28 07 28
A Car	4.4	G5	6 48 59.2	-53 34 30	ζ Vol	3.9	K0	7 42 19.5	-72 30 37
θ Gem	3.6	A2	6 50 09.3	+34 00 41	c Pup	3.7	K5	7 43 49.7	-37 52 14
15 C Ma	4.7	B1	6 51 49.1	-20 10 25	o Pup	4.6	B2	7 46 25.4	-25 50 12
38 Gem	4.7	F0	6 52 23.3	+13 13 49	Q Pup	4.6	K0	7 47 08.7	-46 58 33
θ C Ma	4.2	K2	6 52 19.9	-11 59 14	ξ Pup	3.5	G0 _p	7 47 36.7	-24 45 30
16 C Ma	4.1	K2 _p	6 52 28.3	-24 07 58	P Pup	4.2	B0	7 48 01.1	-46 16 18
24 H. Cam	4.7	K5	6 54 15.9	+77 01 57	a Pup	3.8	G5	7 50 50.5	-40 28 18
15 Lyn	4.5	G0	6 53 49.1	+58 28 39	b Pup	4.5	B3	7 51 13.7	-38 45 30
π C Ma	4.6	F5	6 53 53.3	-20 05 03	J Pup	4.3	B1	7 52 07.6	-47 59 53
ι C Ma	4.4	B5	6 54 21.1	-17 00 04	11 Pup	4.3	F8	7 55 08.3	-22 46 20
ϵ C Ma	1.6	B1	6 57 03.2	-28 55 00	χ Car	3.6	B3	7 55 45.7	-52 52 28
σ C Ma	3.7	K5	7 00 07.5	-27 52 35	V Pup	4-5	B1 _p	7 57 05.3	-49 08 08
σ^2 C Ma	3.1	B5 _p	7 01 21.2	-23 46 25	232 G. Pup	4.6	A2	7 58 04.4	-18 17 18
ζ Gem	3.9	G0 _p	7 01 44.3	+20 37 50	+2°1854	4.5	K0	8 00 11.1	+ 2 26 45
γ C Ma	4.1	B5	7 01 56.9	-15 34 22	ζ Pup	2.3	Od	8 02 10.7	-39 53 22
δ C Ma	2.0	F8 _p	7 06 45.9	-26 19 43	ρ Pup	2.9	F5	8 05 50.4	-24 11 16
τ Gem	4.5	K0	7 08 35.7	+30 18 45	ζ Mon	4.4	G0	8 06 35.0	- 2 51 58
γ^2 Vol	3.9	K0	7 09 05.7	-70 26 03	16 Pup	4.3	B3	8 07 14.4	-19 07 37
δ Mon	4.1	A0	7 09 49.3	- 0 25 30	ϵ Vol	4.5	B5	8 07 48.5	-68 29 58
I Pup	4.5	F0	7 11 25.2	-46 41 30	γ^2 Vel	1.9	Oa _p	8 08 18.0	-47 13 05
L ² Pup	3-6	M5 _e	7 12 19.0	-44 34 25	19 Pup	4.7	K0	8 09 23.7	-12 48 26
27 C Ma	4.7	B5 _p	7 12 37.3	-26 16 56	h ¹ Pup	4.4	K5	8 09 55.7	-39 29 55
ω C Ma	3.8	B3 _p	7 13 11.3	-26 42 08	h ² Pup	4.4	K0	8 12 37.6	-40 13 29
λ Gem	3.6	A2	7 15 47.7	+16 36 51	β Cnc	3.8	K2	8 14 20.8	+ 9 18 37
π Pup	2.7	K5	7 15 43.8	-37 01 29	g Pup	4.4	A5	8 17 03.4	-36 32 04
ν Pup	4.7	B3	7 16 53.0	-36 39 36	31 Lyn	4.4	K5	8 20 06.2	+43 19 05
30 C Ma	4.4	Oe5	7 17 02.9	-24 52 48	α Cha	4.1	F5	8 19 35.4	-76 47 38
δ Vol	4.0	F5	7 16 51.3	-67 53 03	ϵ Car	1.7	K0, B	8 21 41.7	-59 22 49
δ Gem	3.5	F0	7 17 44.1	+22 03 28	θ Cha	4.3	K0	8 21 52.7	-77 21 22
η C Ma	2.4	B5 _p	7 22 30.7	-29 13 26	Br. 1197	3.9	A0	8 23 39.7	- 3 46 29
ι Gem	3.9	K0	7 23 14.7	+27 52 45	β Vol	3.6	K0	8 25 18.5	-66 00 11
21 Lyn	4.4	A0	7 23 42.1	+49 17 35	o U Ma	3.5	G0	8 26 57.5	+60 51 14

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
δ Hya	4.2	A0	8 35 32.4	+ 5 50 40	ψ Vel	3.6	F5	9 29 07.3	-40 17 27
ϵ Vel	4.1	A5	8 36 14.2	-42 50 54	λ Leo	4.5	K5	9 29 26.5	+23 08 43
σ Hya	4.5	K0	8 36 40.0	+ 3 28 59	32 Hya	4.5	A3	9 29 56.6	- 1 00 27
β Pyx	4.0	G5	8 38 32.2	-35 09 55	θ U Ma	3.3	F8 p	9 30 11.6	+51 51 39
\circ Vel	3.7	B3	8 39 08.8	-52 46 45	N Vel	3.0	K5	9 30 00.3	-56 51 27
53 G. Vel	4.1	F5 p	8 39 17.9	-46 30 21	24 U Ma	4.6	G0	9 30 58.8	+70 00 28
d Car	4.4	B2	8 39 44.1	-59 37 04	1 H. Dra	4.6	K2	9 31 32.4	+81 30 20
γ Cnc	4.7	A0	8 40 58.4	+21 36 49	R Car	4-10	M5 e	9 31 14.3	-62 36 41
η Hya	4.3	B3	8 41 08.1	+ 3 32 36	10 L Mi	4.6	G5	9 31 46.7	+36 34 34
31 Mon	4.7	G0	8 41 42.5	- 7 05 19	26 U Ma	4.6	A0	9 32 05.7	+52 13 50
α Pyx	3.7	B2	8 41 59.0	-33 02 28	h Car	4.2	B5	9 33 17.0	-59 03 03
δ Cnc	4.2	K0	8 42 24.9	+18 18 09	M Vel	4.5	A5	9 35 23.6	-49 10 31
d Vel	4.1	G5	8 42 58.2	-42 30 13	ι Hya	4.1	K0	9 37 48.8	- 0 57 38
δ Vel	2.0	A0	8 43 36.0	-54 33 41	m Car	4.7	B9	9 38 14.5	-61 08 47
ι Cnc	4.2	G5	8 44 16.8	+28 54 27	\circ Leo	3.8	F5, A3	9 39 01.0	+10 04 31
12 Hya	4.4	G5	8 44 29.1	-13 24 02	I Hya	4.7	B2 p	9 39 27.4	-23 24 32
ϵ Hya	3.5	F8	8 44 39.5	+ 6 34 00	ϵ Leo	3.1	G0 p	9 43 35.1	+23 57 33
a Vel	4.1	A0	8 44 40.2	-45 53 40	l Car	4-5	G0	9 44 08.8	-62 19 22
f Car	4.6	B3	8 45 40.6	-56 37 20	ν Car	3.1	F0	9 46 06.2	-64 53 09
ρ Hya	4.4	A0	8 46 18.9	+ 5 59 12	ν U Ma	3.9	F0	9 48 09.7	+59 13 41
γ Pyx	4.2	K2	8 48 50.0	-27 33 38	ϕ U Ma	4.5	A2	9 49 23.8	+54 15 08
ζ Hya	3.3	K0	8 53 16.8	+ 6 05 56	39 Hya	4.3	K0	9 49 33.2	-14 39 29
c Car	4.0	B8	8 54 08.6	-60 29 28	m Vel	4.6	G5	9 50 07.8	-46 21 35
α Cnc	4.3	A3	8 56 18.1	+12 00 49	μ Leo	4.1	K0	9 50 29.5	+26 11 46
ι U Ma	3.1	A5	8 56 28.7	+48 12 00	ϕ Vel	3.7	B5	9 55 27.3	-54 22 36
10 U Ma	4.1	F5	8 58 03.0	+41 56 33	ν^2 Hya	4.7	B8	10 03 10.5	-12 52 12
91 G. Vel	4.4	F8	8 58 35.7	-41 05 50	21 L Mi	4.5	A5	10 05 04.6	+35 26 26
κ U Ma	3.7	A0	9 00 54.2	+47 18 58	η Leo	3.6	A0 p	10 05 09.2	+16 57 30
α Vol	4.2	A5	9 01 49.2	-66 14 10	31 Leo	4.6	K2	10 05 47.0	+10 11 40
c Vel	3.7	K0	9 02 46.4	-46 56 16	15 Sex	4.5	A0	10 05 53.4	- 0 10 31
Pi.8 ^b 245	4.7	G5	9 03 59.5	+38 36 48	α Leo	1.3	B8	10 06 14.6	+12 09 48
G Car	4.5	F5	9 05 03.5	-72 26 30	λ Hya	3.8	K0	10 08 38.2	-12 09 21
15 U Ma	4.5	A3 p	9 06 03.6	+51 46 03	ω Car	3.6	B8	10 12 47.4	-69 50 20
λ Vel	2.2	K5	9 06 31.4	-43 16 13	q Vel	4.1	A2	10 13 03.2	-41 55 24
τ U Ma	4.7	F5, A5	9 07 38.5	+63 40 40	ζ Leo	3.6	F0	10 14 28.1	+23 37 02
a Car	3.6	B3	9 09 54.8	-58 48 10	λ U Ma	3.5	A2	10 14 41.5	+43 06 53
i Car	4.2	B3	9 10 22.3	-62 09 09	187 G. Car	3.4	K5	10 15 44.7	-61 07 55
θ Hya	3.8	A0	9 12 17.1	+ 2 29 02	γ^1 Leo	2.6	K0	10 17 46.2	+20 02 40
β Car	1.8	A0	9 12 46.2	-69 33 08	-54°3474	4.6	K0	10 18 06.4	-54 49 41
k Vel	4.7	F5	9 14 09.0	-37 14 44	J Vel	4.6	B5 p	10 19 25.3	-55 50 29
g Car	4.2	K5	9 15 04.4	-57 22 24	μ U Ma	3.2	K5	10 19 57.2	+41 42 05
38 Lyn	3.8	A2	9 16 21.7	+36 58 23	I Car	4.1	F5	10 23 36.4	-73 49 40
ι Car	2.2	F0	9 16 01.2	-59 06 25	μ Hya	4.1	K5	10 24 09.3	-16 37 53
α Lyn	3.3	K5	9 18 37.4	+34 33 46	α Ant	4.4	K5	10 25 19.1	-30 51 49
κ Vel	2.6	B3	9 20 52.5	-54 50 22	β L Mi	4.4	K0	10 25 34.6	+36 54 46
κ Leo	4.6	K0	9 22 19.7	+26 21 20	s Car	4.1	F0	10 26 24.4	-58 32 05
α Hya	2.2	K2	9 25 37.3	- 8 29 04	ρ Leo	3.8	B0 p	10 30 42.4	+ 9 30 47
ϵ Ant	4.6	K2	9 27 35.6	-35 46 33	p Car	3.6	B5 p	10 30 35.8	-61 28 45
23 U Ma	3.7	F0	9 28 23.8	+63 14 17	r Car	4.5	K5	10 34 02.8	-57 21 01

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
γ Cha	4.1	M0	10 35 00.8	-78 24 01	π Vir	4.6	A3	11 58 49.4	+ 6 50 14
p Vel	4.1	F2, A3	10 35 37.0	-48 01 03	θ Cru	4.5	A5	12 00 58.5	-63 05 25
t Car	4.7	K5	10 37 13.4	-58 58 28	ο Vir	4.2	G5	12 03 10.3	+ 8 57 18
x Vel	4.4	G0	10 37 42.6	-55 23 41	η Cru	4.3	F0	12 04 46.8	-64 23 27
θ Car	3.0	B0	10 41 31.5	-64 11 04	δ Cen	2.9	B3 _p	12 06 16.6	-50 29 59
w Car	4.5	K5	10 42 00.5	-60 21 23	α Crv	4.2	F2	12 06 20.7	-24 30 21
μ Vel	2.8	G5	10 45 02.6	-49 12 30	ε Crv	3.2	K0	12 08 03.8	-22 23 51
δ ² Cha	4.6	B3	10 45 26.0	-80 19 45	ρ Cen	4.2	B3	12 09 33.1	-52 08 45
ν Hya	3.3	K0	10 47 39.0	-15 59 02	δ Cru	3.1	B3	12 13 00.5	-58 31 35
46 L Mi	3.9	K0	10 51 04.8	+34 25 51	δ U Ma	3.4	A2	12 13 27.3	+57 15 17
u Car	3.9	K0	10 51 51.7	-58 38 26	γ Crv	2.8	B8	12 13 44.7	-17 19 12
54 Leo	4.5	A0	10 53 27.0	+24 57 49	ε Mus	4.2	M4	12 15 23.5	-67 44 18
ι Ant	4.7	K0	10 54 51.0	-36 55 21	β Cha	4.4	B5	12 15 57.7	-79 05 25
α Crt	4.2	K0	10 57 49.4	-18 05 08	ζ Cru	4.3	B3	12 16 15.2	-63 46 51
239 G. Vel	4.6	A2	10 58 18.8	-42 00 39	η Vir	4.0	A0	12 17 51.5	- 0 26 41
β U Ma	2.4	A0	10 59 26.4	+56 35 50	ε Cru	3.6	K2	12 19 11.3	-60 10 49
60 Leo	4.4	A0	11 00 11.8	+20 23 41	α ¹ Cru	1.0	B1	12 24 21.4	-62 52 40
α U Ma	1.9	K0	11 01 16.5	+61 58 02	γ Com	4.6	K0	12 24 56.8	+28 29 26
χ Leo	4.7	F0	11 02 57.3	+ 7 33 09	σ Cen	4.2	B3	12 25 52.0	-50 00 34
260 G. Car	4.0	F8 _p	11 06 52.4	-58 45 29	δ Crv	3.1	A0	12 27 47.5	-16 17 35
ψ U Ma	3.1	K0	11 07 25.3	+44 42 57	γ Cru	1.6	M3	12 28 56.0	-56 53 22
β Crt	4.5	A2	11 09 41.3	-22 36 26	γ Mus	4.0	B5	12 30 03.2	-71 54 44
y Car	4.7	F5 _p	11 10 52.6	-60 05 59	η Crv	4.4	F0	12 30 00.3	-15 58 29
δ Leo	2.6	A3	11 11 59.0	+20 44 35	κ Dra	3.9	B5 _p	12 31 47.1	+70 00 30
θ Leo	3.4	A0	11 12 08.6	+15 38 54	β C Vn	4.3	G0	12 31 50.8	+41 34 28
φ Leo	4.6	A5	11 14 37.6	- 3 25 58	β Crv	2.8	G5	12 32 16.9	-23 10 33
ξ U Ma	3.9	G0	11 16 03.2	+31 45 16	α Mus	2.9	B3	12 34 46.6	-68 54 55
ν U Ma	3.7	K0	11 16 19.4	+33 18 46	τ Cen	4.0	A2	12 35 30.3	-48 19 17
δ Crt	3.8	K0	11 17 20.3	-14 33 43	γ Cen	2.4	A0	12 39 18.0	-48 44 25
σ Leo	4.1	A0	11 19 04.4	+ 6 14 56	γ Vir	2.9	F0	12 39 37.9	- 1 13 49
π Cen	4.3	B5	11 19 10.5	-54 16 18	w Cen	4.6	K0	12 40 21.9	-48 35 37
ι Leo	4.0	F5	11 21 50.4	+10 44 59	ι Cru	4.7	K0	12 43 15.9	-60 45 43
γ Crt	4.1	A5	11 22 52.8	-17 27 51	β Mus	3.3	B3	12 43 48.4	-67 53 23
λ Dra	4.1	M0	11 29 03.1	+69 33 07	β Cru	1.5	B1	12 45 22.2	-59 28 14
ξ Hya	3.7	G5	11 31 01.8	-31 38 10	e Cen	4.3	K2	12 50 50.4	-48 43 34
λ Cen	3.3	B9	11 33 55.6	-62 47 54	n Cen	4.3	A5	12 51 12.8	-39 57 42
ν Leo	4.5	K0	11 34 54.0	- 0 36 10	μ Cru	4.3	B3	12 52 13.7	-56 57 40
λ Mus	3.8	A5	11 43 42.4	-66 30 25	ε U Ma	1.7	A0 _p	12 52 16.5	+56 10 36
ν Vir	4.2	M0	11 43 48.2	+ 6 45 13	δ Vir	3.7	M0	12 53 35.2	+ 3 36 52
χ U Ma	3.8	K0	11 43 56.7	+48 00 04	α ² C Vn	2.9	A0 _p	12 54 09.5	+38 32 02
65 G. Cen	4.2	G0	11 44 34.0	-60 57 22	δ Mus	3.6	K2	12 59 29.4	-71 20 02
93 Leo	4.5	F8	11 45 55.4	+20 26 28	ε Vir	2.9	K0	13 00 11.1	+11 10 25
μ Mus	4.7	K5	11 46 18.2	-66 35 32	ξ ² Cen	4.4	B3	13 04 33.8	-49 41 33
β Leo	2.2	A2	11 47 01.2	+14 47 44	θ Vir	4.5	A0	13 07 52.6	- 5 19 33
j Cen	4.5	B5	11 47 43.5	-63 33 58	α Com	4.5	F5	13 08 02.5	+17 44 26
β Vir	3.8	F8	11 48 36.7	+ 1 59 24	β Com	4.3	G0	13 10 00.5	+28 04 49
B Cen	4.7	K0	11 49 08.2	-44 57 03	20 C Vn	4.7	F0	13 15 45.1	+40 46 57
β Hya	4.4	B9	11 50 53.0	-33 41 08	γ Hya	3.3	G5	13 16 44.5	-22 57 40
γ U Ma	2.5	A0	11 51 44.1	+53 55 02	ι Cen	2.9	A2	13 18 20.5	-36 30 07

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
<i>J</i> Cen	4.6	B5	13 20 01.8	-60 46 45	γ Boo	3.0	F0	14 30 28.0	+38 28 57
<i>m</i> Cen	4.5	G0	13 21 17.9	-64 19 38	η Cen	2.6	B3 _p , A2 _p	14 32 57.4	-41 59 00
ζ U Ma	2.4	A2 _p	13 22 19.1	+55 08 01	σ Boo	4.5	F0	14 32 56.3	+29 55 05
α Vir	1.2	B2	13 23 04.9	-10 57 11	ρ Lup	4.1	B5	14 35 11.0	-49 15 09
80 U Ma	4.0	A5	13 23 37.6	+55 11 45	α Cen	0.1	G0	14 36 52.0	-60 40 17
<i>R</i> Hya	3-10	M7e	13 27 31.3	-23 04 31	α Cir	3.4	F0	14 39 15.0	-64 48 09
<i>d</i> Cen	4.0	K0	13 28 43.0	-39 12 05	α Lup	2.9	B2	14 39 15.5	-47 13 04
ζ Vir	3.4	A2	13 32 39.2	- 0 23 32	ζ Boo	3.9	A2	14 39 14.2	+13 53 56
24 C Vn	4.6	A3	13 32 49.3	+49 13 11	<i>b</i> Cen	4.1	B3	14 39 28.0	-37 37 23
ϵ Cen	2.6	B1	13 37 20.4	-53 15 50	μ Vir	3.9	F5	14 40 56.9	- 5 29 07
83 U Ma	4.7	M2	13 39 13.3	+54 53 01	371 G. Cen	4.1	K0	14 41 12.2	-35 00 10
1 Cen	4.4	F5	13 43 24.5	-32 50 32	α Aps	3.8	K5	14 42 47.9	-78 52 38
<i>M</i> Cen	4.7	K0	13 44 06.6	-51 13 59	ϵ Boo	2.7	K0	14 43 14.4	+27 14 31
τ Boo	4.5	F5	13 45 21.6	+17 39 19	σ Boo	4.7	K0	14 43 22.4	+17 07 57
η U Ma	1.9	B3	13 45 58.0	+49 30 44	109 Vir	3.8	A0	14 44 13.4	+ 2 03 37
ν Cen	3.5	B2	13 47 05.8	-41 29 21	58 Hya	4.6	K2	14 47 56.0	-27 47 42
2 Cen	4.4	M6	13 47 07.2	-34 15 07	α^2 Lib	2.9	A3	14 48 39.7	-15 52 36
μ Cen	3.3	B2 _p	13 47 11.8	-42 16 31	σ Lup	4.5	B5	14 49 01.1	-43 24 40
ν Boo	4.3	K5	13 47 32.8	+15 59 44	ξ Boo	4.6	G5	14 49 32.5	+19 15 57
3 Cen	4.7	B5	13 49 30.6	-32 47 48	β U Mi	2.2	K5	14 50 48.0	+74 19 08
η Boo	2.8	G0	13 52 46.8	+18 35 51	16 Lib	4.6	F0	14 55 05.4	- 4 11 05
ζ Cen	3.1	B2 _p	13 53 02.0	-47 05 32	β Lup	2.8	B2 _p	14 55 54.1	-42 58 27
294 G. Cen	4.7	K0	13 54 43.9	-63 29 30	κ Cen	3.3	B3	14 56 33.0	-41 56 42
ϕ Cen	4.0	B3	13 55 49.8	-41 54 22	β Boo	3.6	G5	15 00 26.3	+40 32 50
ν^1 Cen	4.2	B3	13 56 11.9	-44 36 33	110 Vir	4.6	K0	15 00 52.6	+ 2 14 50
ν^2 Cen	4.4	F5	13 59 13.1	-45 24 38	σ Lib	3.4	M3	15 01 43.4	-25 07 34
τ Vir	4.3	A2	13 59 36.5	+ 1 44 14	π Lup	4.0	B5	15 02 23.1	-46 53 46
β Cen	0.9	B1	14 00 58.9	-60 10 52	ψ Boo	4.7	K0	15 02 43.8	+27 06 09
χ Cen	4.5	B3	14 03 35.7	-40 59 20	λ Lup	4.4	B3	15 06 08.3	-45 07 39
α Dra	3.6	A0 _p	14 03 18.3	+64 33 59	κ^1 Lup	4.1	B9	15 09 08.6	-48 35 14
π Hya	3.5	K0	14 04 05.2	-26 29 26	ζ Lup	3.5	K0	15 09 23.9	-51 56 55
θ Cen	2.3	K0	14 04 19.2	-36 10 27	ι Lib	4.7	A0 _p	15 09 56.2	-19 38 30
κ Vir	4.3	K0	14 10 45.5	-10 05 19	δ Boo	3.5	K0	15 13 53.3	+33 27 47
κ Boo	4.6	A5	14 12 03.0	+51 58 35	β Cir	4.2	A3	15 14 21.9	-58 39 13
α Boo	0.2	K0	14 13 50.1	+19 23 23	γ Tr A	3.1	A0	15 15 08.7	-68 32 01
ι Vir	4.2	F5	14 13 54.8	- 5 48 38	β Lib	2.7	B8	15 14 51.0	- 9 14 12
λ Boo	4.3	A0	14 14 51.8	+46 16 16	2 Lup	4.4	K0	15 15 23.4	-30 00 11
ι Lup	4.1	B3	14 16 49.9	-45 52 28	μ Lup	4.4	B8	15 15 44.3	-47 43 46
λ Vir	4.6	A2	14 16 56.4	-13 11 17	δ Lup	3.4	B2	15 18 44.3	-40 30 15
ν Cen	4.4	B5	14 17 30.9	-56 12 12	ϕ^1 Lup	3.6	K5	15 19 15.6	-36 07 04
ψ Cen	4.2	A0	14 18 06.9	-37 42 08	ϵ Lup	3.7	B3	15 19 57.3	-44 32 50
δ Oct	4.1	K2	14 20 16.2	-83 29 14	γ Cir	4.5	B5, F8	15 20 10.5	-59 10 43
σ Cen	4.5	B5	14 20 33.8	-39 19 49	ϕ^2 Lup	4.7	B3	15 20 35.5	-36 43 00
τ^1 Lup	4.6	B3	14 23 33.5	-45 02 30	γ U Mi	3.1	A2	15 20 46.5	+71 58 35
τ^2 Lup	4.5	F8	14 23 35.8	-45 11 59	<i>k</i> Lup	4.7	A0	15 22 44.1	-38 35 36
θ Boo	4.1	F8	14 23 50.1	+52 02 06	μ^1 Boo	4.5	F0	15 22 58.7	+37 30 59
5 U Mi	4.4	K2	14 27 35.1	+75 52 26	ι Dra	3.5	K0	15 24 02.2	+59 06 20
σ Lup	4.6	B2	14 29 54.5	-50 16 51	β Cr B	3.7	F0 _p	15 26 10.7	+29 14 33
ρ Boo	3.8	K0	14 30 06.3	+30 32 46	θ Cr B	4.2	B5	15 31 18.9	+31 29 35

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
γ Lup	2.9	B3	15 32 28.0	-41 02 02	γ Her	3.8	F0	16 20 09.2	+19 14 45
ε Tr A	4.1	K0	15 33 02.1	-66 11 05	ξ Cr B	4.7	K0	16 20 32.2	+30 59 01
δ Ser	4.2	F0	15 32 53.4	+10 40 17	ψ Oph	4.6	K0	16 21 45.5	-19 56 44
α Cr B	2.3	A0	15 32 59.6	+26 50 53	ω Her	4.5	A0 _p	16 23 34.1	+14 07 26
γ Lib	4.0	K0	15 33 17.1	-14 39 27	η Dra	2.9	G5	16 23 26.6	+61 36 15
ν Lib	3.8	K2	15 34 35.4	-28 00 15	ν Oph	4.7	A2	16 25 38.2	- 8 17 02
ω Lup	4.3	K5	15 35 21.0	-42 26 16	γ Aps	3.9	K0	16 27 15.0	-78 48 41
τ Lib	3.8	B3	15 36 11.6	-29 38 52	α Sco	1.2	M0, A3	16 26 57.0	-26 20 42
ψ Lup	4.6	K0	15 37 13.2	-34 16 58	β Her	2.8	K0	16 28 29.9	+21 34 32
g Lup	4.7	F5	15 38 25.8	-44 31 49	N Sco	4.3	B3	16 28 45.8	-34 37 09
ι Ser	4.5	A2	15 39 45.9	+19 47 52	φ Oph	4.4	K0	16 28 50.7	-16 31 38
γ Cr B	3.9	A0	15 41 03.7	+26 25 16	λ Oph	3.8	A0	16 28 53.7	+ 2 04 12
α Ser	2.7	K0	15 42 17.7	+ 6 33 00	ω Oph	4.6	F0	16 29 45.6	-21 22 57
β Ser	3.7	A2	15 44 20.4	+15 32 44	σ Her	4.2	A0	16 32 48.7	+42 31 07
λ Ser	4.4	G0	15 44 30.0	+ 7 28 38	τ Sco	2.9	B0	16 33 23.3	-28 08 05
ζ U Mi	4.3	A2	15 45 26.6	+77 55 06	H Sco	4.3	M2	16 33 44.2	-35 10 30
κ Ser	4.3	K5	15 46 56.2	+18 15 50	ζ Oph	2.7	B0	16 34 57.2	-10 29 16
μ Ser	3.6	A0	15 47 31.8	- 3 18 33	β Aps	4.2	K0	16 37 18.9	-77 26 15
δ Cr B	4.7	G5	15 47 54.9	+26 11 22	ζ Her	3.0	G0	16 39 46.6	+31 40 27
χ Lup	4.1	B9	15 48 24.6	-33 30 25	η Her	3.6	K0	16 41 31.4	+38 59 50
ε Ser	3.7	A2	15 48 49.2	+ 4 35 48	α Tr A	1.9	K2	16 44 24.6	-68 57 26
2 Sco	4.7	B3	15 51 12.3	-25 12 34	η Ara	3.7	K5	16 46 19.2	-58 58 21
β Tr A	3.0	F0	15 51 35.9	-63 18 34	ε Sco	2.4	K0	16 47 34.1	-34 13 21
χ Her	4.6	G0	15 51 17.4	+42 33 45	20 Oph	4.7	F5	16 47 37.1	-10 42 50
θ Lib	4.3	K0	15 51 32.6	-16 36 49	μ ¹ Sco	3.1	B3 _p	16 49 09.3	-37 58 51
ρ Sco	4.0	B3	15 54 24.6	-29 05 56	μ ² Sco	3.6	B2	16 49 37.3	-37 57 04
γ Ser	3.9	F5	15 54 36.2	+15 47 27	ε U Mi	4.4	G5	16 49 59.7	+82 06 21
48 Lib	4.7	B3 _p	15 55 56.7	-14 09 56	ζ Sco	3.7	K5	16 51 45.8	-42 17 41
ε Cr B	4.2	K0	15 55 55.8	+26 59 33	ι Oph	4.3	B8	16 52 06.8	+10 13 47
π Sco	3.0	B2	15 56 25.6	-26 00 02	ζ Ara	3.1	K5	16 55 18.1	-55 55 45
η Lup	3.6	B3	15 57 27.8	-38 17 03	κ Oph	3.4	K0	16 55 46.4	+ 9 26 09
δ Sco	2.5	B0	15 57 57.8	-22 30 34	ε Ara	4.1	K2	16 56 23.3	-53 06 04
η Nor	4.7	G5	16 00 15.8	-49 07 12	ε Her	3.9	A0	16 58 45.4	+30 59 03
θ Dra	4.1	F8	16 01 08.1	+58 40 17	η Oph	2.6	A2	17 08 04.9	-15 40 38
ν Her	4.6	B9	16 01 33.0	+46 08 49	η Sco	3.4	F2	17 09 17.0	-43 11 19
ξ Sco	4.2	F8	16 02 09.9	-11 15 52	ζ Dra	3.2	B5	17 08 40.0	+65 45 50
β ¹ Sco	2.9	B1	16 03 06.4	-19 41 51	α Her	3.5	M3	17 12 49.3	+14 26 04
θ Lup	4.3	B3	16 03 57.5	-36 41 43	δ Her	3.2	A2	17 13 23.2	+24 53 06
ω ¹ Sco	4.1	B2	16 04 27.8	-20 33 45	π Her	3.4	K5	17 13 39.1	+36 51 11
ω ² Sco	4.6	G0	16 05 03.3	-20 45 44	68 Her	4-5	B3	17 15 50.8	+33 08 31
φ Her	4.3	B9 _p	16 07 30.4	+45 02 19	ζ Aps	4.7	K2	17 17 48.0	-67 43 54
ν Sco	4.3	B3	16 09 40.0	-19 21 30	ξ Oph	4.5	F5	17 18 36.2	-21 04 18
13 Sco	4.7	B3	16 09 50.0	-27 49 28	ν Ser	4.3	A0	17 18 34.5	-12 48 29
δ Tr A	4.0	G0	16 11 46.8	-63 35 09	θ Oph	3.4	B3	17 19 33.0	-24 57 41
δ Oph	3.0	M0	16 12 14.8	- 3 35 34	β Ara	2.8	K2	17 21 58.1	-55 29 40
ε Oph	3.3	K0	16 16 12.1	- 4 35 47	γ Ara	3.5	B1	17 22 01.2	-56 20 33
γ ² Nor	4.1	K0	16 16 50.2	-50 03 34	ρ Her	4.5	A0	17 22 18.1	+37 10 54
σ Sco	3.1	B1	16 18 45.1	-25 29 55	44 Oph	4.3	F0	17 23 55.5	-24 08 25
τ Her	3.9	B5	16 18 32.2	+46 24 28	27 H. Oph	4.6	F0	17 24 30.4	- 5 03 11

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
σ Oph	4.4	K0	17 24 31.7	+ 4 10 25	δ Sgr	2.8	K0	18 18 26.0	-29 50 49
45 Oph	4.4	F5	17 24 47.8	-29 49 58	κ Lyr	4.3	K0	18 18 27.5	+36 02 44
δ Ara	3.8	B8	17 27 28.9	-60 39 11	ξ Pav	4.2	K2	18 19 32.4	-61 30 53
ν Sco	2.8	B3	17 28 02.5	-37 15 58	η Ser	3.4	K0	18 19 14.3	- 2 54 39
α Ara	3.0	B3 _p	17 28 44.7	-49 50 48	ϵ Sgr	1.9	A0	18 21 31.0	-34 24 20
λ Her	4.5	K0	17 29 07.2	+26 08 22	ϕ Dra	4.2	A0 _p	18 21 19.9	+71 19 01
β Dra	3.0	G0	17 29 31.6	+52 19 49	109 Her	3.9	K0	18 21 59.5	+21 45 00
λ Sco	1.7	B2	17 30 53.4	-37 04 36	χ Dra	3.7	F8	18 21 46.7	+72 42 57
σ Ara	4.6	A0	17 32 40.6	-46 28 49	α Tel	3.8	B3	18 24 00.4	-45 59 33
α Oph	2.1	A5	17 33 04.6	+12 35 16	λ Sgr	2.9	K0	18 25 30.1	-25 26 44
Q Sco	4.3	K0	17 33 47.3	-38 36 33	ζ Tel	4.1	K0	18 25 45.0	-49 05 41
θ Sco	2.0	F0	17 34 26.5	-42 58 28	γ Sct	4.7	A3	18 26 55.0	-14 35 35
ξ Ser	3.6	A5	17 35 17.6	-15 22 31	θ Cr A	4.7	G5	18 30 38.8	-42 20 36
μ Oph	4.6	B8	17 35 40.1	- 8 05 46	α Sct	4.1	K0	18 33 01.8	- 8 16 25
ι Her	3.8	B3	17 38 20.0	+46 01 36	α Lyr	0.1	A0	18 35 35.0	+38 44 43
\circ Ser	4.4	A2	17 39 09.9	-12 51 20	ζ Pav	4.1	K0	18 38 22.3	-71 27 57
κ Sco	2.5	B2	17 39 43.0	-39 00 41	δ Sct	4.7	F0	18 40 05.0	- 9 05 33
η Pav	3.6	K0	17 41 48.1	-64 42 27	ϕ Sgr	3.3	B8	18 43 09.4	-27 02 02
β Oph	2.9	K0	17 41 29.7	+ 4 34 57	ϵ Lyr	4.5	A5	18 43 03.2	+39 34 12
ι^1 Sco	3.1	F5 _p	17 44 47.1	-40 06 49	ζ Lyr	4.3	A3	18 43 23.6	+37 33 44
X Sgr	4-5	F5-G0	17 45 02.4	-27 49 03	110 Her	4.3	F5	18 43 56.3	+20 30 24
μ Her	3.5	G5	17 44 53.5	+27 44 34	β Sct	4.5	G0	18 45 03.1	- 4 47 32
γ Oph	3.7	A0	17 45 53.1	+ 2 43 15	111 Her	4.4	A3	18 45 15.2	+18 08 08
G Sco	3.2	K2	17 47 08.0	-37 01 57	R Sct	4-9	K0 _p	18 45 20.8	- 5 44 59
δ U Mi	4.4	A0	17 45 04.3	+86 36 23	λ Pav	4.4	B2	18 48 30.9	-62 14 10
ξ Dra	3.9	K0	17 52 50.1	+56 52 42	β^1 Lyr	3-4	B8 _p B2 _p	18 48 36.1	+33 18 54
θ Her	4.0	K0	17 54 52.8	+37 15 17	κ Pav	4-5	F5 _p	18 52 50.1	-67 17 12
γ Dra	2.4	K5	17 55 40.5	+51 29 34	σ Sgr	2.1	B3	18 52 47.1	-26 20 54
ξ Her	3.8	K0	17 56 12.5	+29 15 03	113 Her	4.6	G0, A3	18 53 03.5	+22 35 35
ν Oph	3.5	K0	17 56 49.4	- 9 46 13	δ Lyr	4.5	M4	18 53 06.2	+36 50 49
ν Her	4.5	F0	17 56 58.2	+30 11 29	θ^1 Ser	4.5	A5	18 54 13.8	+ 4 09 00
93 Her	4.7	K0	17 58 16.5	+16 45 07	R Lyr	4-5	M3	18 54 07.0	+43 53 33
ζ Ser	4.6	F0	17 58 22.1	- 3 41 21	ξ^2 Sgr	3.6	K0	18 55 20.6	-21 09 40
67 Oph	3.9	B5 _p	17 58 38.4	+ 2 55 55	γ Lyr	3.3	A0 _p	18 57 26.7	+32 38 01
68 Oph	4.4	A2	17 59 43.3	+ 1 18 16	ϵ Aql	4.2	K0	18 57 48.3	+15 00 45
W Sgr	4-5	F8 _p	18 02 27.8	-29 35 02	12 Aql	4.1	K0	18 59 32.6	- 5 47 49
γ Sgr	3.1	K0	18 03 14.2	-30 25 36	ζ Sgr	2.7	A2	19 00 04.0	-29 56 21
θ Ara	3.9	B1 _p	18 03 30.9	-50 05 47	\circ Sgr	3.9	K0	19 02 17.2	-21 48 07
70 Oph	4.1	K0	18 03 25.9	+ 2 30 26	γ Cr A	4.3	F8	19 03 42.9	-37 07 22
π Pav	4.4	A5	18 04 43.7	-63 40 22	ζ Aql	3.0	A0	19 03 34.2	+13 48 09
71 Oph	4.7	G5	18 05 23.5	+ 8 43 38	λ Aql	3.5	B9	19 04 07.5	- 4 56 39
-28°14174	4.7	K0	18 05 32.9	-28 27 48	τ Sgr	3.4	K0	19 04 26.6	-27 43 51
72 Oph	3.7	A3	18 05 27.1	+ 9 33 24	δ Cr A	4.7	K0	19 05 33.9	-40 33 38
\circ Her	3.8	A0	18 05 58.8	+28 45 21	α Cr A	4.1	A2	19 06 45.2	-37 58 07
102 Her	4.3	B3	18 07 02.8	+20 48 24	β Cr A	4.2	G5	19 07 16.7	-39 24 22
ϵ Tel	4.6	K0	18 08 15.5	-45 57 49	π Sgr	3.0	F2	19 07 23.1	-21 05 20
μ Sgr	4.0	B8 _p	18 11 22.2	-21 04 16	η Lyr	4.5	B3	19 12 23.7	+39 04 34
η Sgr	3.2	M3	18 14 55.1	-36 46 32	δ Dra	3.2	K0	19 12 33.0	+67 35 28
-27°12684	4.7	K5	18 15 32.9	-27 03 32	1 Vul	4.6	B5	19 14 29.8	+21 19 07

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
θ Lyr	4.5	K0	19 14 58.7	+38 03 41	39 Cyg	4.6	K2	20 22 15.6	+32 03 36
κ Cyg	4.0	K0	19 16 10.7	+53 17 38	41 Cyg	4.1	F5 _p	20 27 45.6	+30 14 02
τ Dra	4.6	K0	19 16 19.9	+73 16 54	θ Cep	4.3	A5	20 28 54.8	+62 51 33
ρ Sgr	3.9	A5	19 19 21.2	-17 55 27	ϵ Del	4.0	B5	20 31 18.1	+11 09 58
ν Sgr	4.6	B8 _p , F2 _p	19 19 26.2	-16 01 54	ζ Del	4.7	A2	20 33 26.2	+14 32 06
β^1 Sgr	4.3	B8	19 19 45.9	-44 32 10	α Ind	3.2	K0	20 34 45.6	-47 25 57
β^2 Sgr	4.5	F0	19 20 19.9	-44 52 37	β Del	3.7	F5	20 35 40.3	+14 27 18
π Dra	4.6	A2	19 20 28.0	+65 38 14	71 Aql	4.5	K0	20 36 16.3	- 1 14 46
α Sgr	4.1	B8	19 21 07.0	-40 41 35	α Del	3.9	B8	20 37 46.7	+15 46 11
δ Aql	3.4	F0	19 23 28.8	+ 3 02 01	α Cyg	1.3	A2 _p	20 40 04.0	+45 08 12
α Vul	4.6	M0	19 27 02.4	+24 34 58	η Ind	4.7	F0	20 41 06.7	-52 03 56
ι Cyg	3.9	A2	19 28 41.8	+51 38 38	β Pav	3.6	A5	20 41 22.6	-66 20 56
β^1 Cyg	3.2	K0, A0	19 29 06.4	+27 52 28	δ Del	4.5	A5	20 41 35.4	+14 55 47
μ Aql	4.6	K0	19 32 08.1	+ 7 17 33	ψ Cap	4.3	F8	20 43 43.8	-25 24 58
52 Sgr	4.7	B9	19 34 16.5	-24 58 25	52 Cyg	4.3	K0	20 44 00.5	+30 34 22
ι Aql	4.3	B5	19 34 39.1	- 1 22 36	6 H. Cep	4.6	G0	20 44 21.5	+57 26 08
θ Cyg	4.6	F5	19 35 22.0	+50 07 39	ϵ Cyg	2.6	K0	20 44 35.5	+33 49 10
α Sge	4.4	G0	19 38 18.4	+17 55 14	η Cep	3.6	K0	20 44 28.7	+61 40 59
β Sge	4.4	K0	19 39 15.1	+17 22 55	γ^2 Del	4.5	G5	20 44 48.1	+15 58 44
δ Cyg	3.0	A0	19 43 43.4	+45 01 56	ϵ Aqr	3.8	A0	20 45 30.7	- 9 38 36
γ Aql	2.8	K2	19 44 21.4	+10 30 52	3 Aqr	4.6	M0	20 45 37.6	- 5 10 31
δ Sge	3.8	M0, A0	19 45 36.2	+18 26 04	λ Cyg	4.5	B5	20 45 50.9	+36 20 34
α Aql	0.9	A5	19 48 49.9	+ 8 45 41	ω Cap	4.2	M0	20 49 26.2	-27 04 13
ϵ Dra	4.0	K0	19 48 19.0	+70 09 58	β Ind	3.7	K0	20 51 41.9	-58 36 24
χ Cyg	4-14	M7 _e	19 49 01.5	+32 48 43	57 Cyg	4.7	B3	20 51 49.8	+44 14 06
η Aql	3-4	G0 _p	19 50 26.1	+ 0 54 06	ν Cyg	4.0	A0	20 55 40.8	+41 00 44
13 Vul	4.5	A0	19 51 45.6	+23 58 27	γ Mic	4.7	G5	20 58 50.5	-32 24 56
ι Sgr	4.2	K0	19 52 30.4	-41 58 31	ξ Cyg	3.9	K5	21 03 28.4	+43 46 03
β Aql	3.9	K0	19 53 20.8	+ 6 18 20	ϕ Cap	4.2	A0	21 03 42.0	-17 23 35
59 Sgr	4.6	K2	19 54 29.7	-27 16 39	Δ Cap	4.6	M0	21 04 47.4	-25 10 01
η Cyg	4.0	K0	19 54 48.2	+34 58 34	ν Aqr	4.5	K0	21 07 25.0	-11 32 05
ϵ Pav	4.1	A0	19 56 00.0	-73 01 09	ζ Cyg	3.4	K0	21 11 13.9	+30 03 43
θ^1 Sgr	4.4	B3	19 57 08.2	-35 23 10	δ Equ	4.6	F5	21 12 31.9	+ 9 50 38
γ Sge	3.7	K5	19 56 58.6	+19 22 56	τ Cyg	3.8	F0	21 13 11.5	+37 52 26
15 Vul	4.7	A5	19 59 27.1	+27 38 31	α Equ	4.1	F8, A3	21 13 49.4	+ 5 04 53
62 Sgr	4.6	M3	20 00 12.0	-27 49 22	σ Cyg	4.3	A0 _p	21 15 50.5	+39 13 34
ρ Dra	4.7	K0	20 02 38.6	+67 45 34	ν Cyg	4.4	B3 _p	21 16 16.2	+34 43 41
δ Pav	3.6	G5	20 04 49.1	-66 17 12	θ Ind	4.6	A5	21 17 01.6	-53 37 07
δ Aql	3.4	A0	20 09 14.4	- 0 56 29	α Cep	2.6	A5	21 17 37.5	+62 24 56
κ Cep	4.4	B9	20 10 16.3	+77 35 31	ι Cap	4.3	K0	21 20 01.3	-17 00 22
σ^2 Cyg	3.9	K0, B8	20 12 22.2	+46 37 09	1 Peg	4.3	K0	21 20 14.1	+19 37 57
33 Cyg	4.3	A3	20 12 28.1	+56 26 41	γ Pav	4.3	F8	21 23 09.6	-65 32 56
23 Vul	4.7	K5	20 14 06.6	+27 41 26	ζ Cap	3.9	G5 _p	21 24 23.2	-22 35 08
32 Cyg	4.2	K0, A3	20 14 14.0	+47 35 26	36 Cap	4.6	G5	21 26 26.7	-21 58 57
α^1 Cap	4.5	G0 _p	20 15 25.9	-12 38 00	β Cep	3.3	B1	21 28 09.1	+70 23 06
α^2 Cap	3.8	G5	20 15 50.1	-12 40 13	β Aqr	3.1	G0	21 29 27.2	- 5 44 53
β Cap	3.2	G0, A0	20 18 45.9	-14 54 33	ρ Cyg	4.2	K0	21 32 28.4	+45 24 52
γ Cyg	2.3	F8 _p	20 20 47.5	+40 07 40	ϵ Cap	4.7	B5 _p	21 34 50.6	-19 38 46
α Pav	2.1	B3	20 22 29.7	-56 51 55	ν Oct	3.7	K0	21 37 06.3	-77 34 10

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
γ Cap	3.8	F0p	21 37 52.6	-16 50 38	λ Peg	4.1	K0	22 44 36.1	+23 21 17
ε Peg	2.5	K0	21 42 13.2	+ 9 41 27	ξ Peg	4.3	F5	22 44 41.5	+11 58 02
μ Cyg	4.7	F5	21 42 21.1	+28 33 41	ε Gru	3.7	A2	22 46 08.9	-51 31 40
ι Ps A	4.3	A0	21 42 34.1	-33 12 34	τ Aqr	4.2	K5	22 47 28.5	-13 48 15
μ Cep	4-5	M2	21 42 16.9	+58 35 46	μ Peg	3.7	K0	22 48 04.2	+24 23 24
9 Peg	4.5	G5	21 42 36.9	+17 09 56	ι Cep	3.7	K0	22 48 15.0	+65 59 23
κ Peg	4.3	F5	21 42 49.9	+25 27 37	γ Ps A	4.5	A0	22 50 18.4	-33 05 18
ν Cep	4.5	A2p	21 44 17.6	+60 56 09	λ Aqr	3.8	M0	22 50 31.6	- 7 47 35
δ Cap	3.0	A5	21 44 50.1	-16 18 35	δ Aqr	3.5	A2	22 52 31.7	-16 02 02
π ² Cyg	4.3	B3	21 45 18.7	+49 07 26	δ Ps A	4.3	K0	22 53 44.2	-32 45 14
γ Gru	3.2	B8	21 51.30.7	-37 33 14	α Ps A	1.3	A3	22 55 26.6	-29 50 05
δ Ind	4.6	F0	21 55 12.5	-55 11 02	ζ Gru	4.2	G5	22 58 31.7	-52 58 09
ε Ind	4.7	K5	22 00 18.9	-56 57 06	ο And	3.6	B5, A2p	23 00 04.5	+42 06 38
ο Aqr	4.7	B5p	22 01 14.7	- 2 20 57	β Psc	4.6	B5p	23 01 50.4	+ 3 36 16
ξ Cep	4.6	A3	22 02 37.8	+64 25 57	β Peg	2.6	M0	23 01 49.9	+27 51 56
λ Gru	4.6	K2	22 03 42.6	-39 44 14	α Peg	2.6	A0	23 02 45.9	+14 59 23
α Aqr	3.2	G0	22 03 43.7	- 0 30 54	θ Gru	4.3	F5	23 04 37.9	-43 44 13
ι Aqr	4.3	B8	22 04 16.7	-14 03 52	55 Peg	4.7	M0	23 04 59.2	+ 9 11 35
ι Peg	4.0	F5	22 05 08.8	+25 08 56	π Cep	4.6	G5	23 06 37.1	+75 10 16
α Gru	2.2	B5	22 05 43.2	-47 09 20	88 Aqr	3.8	K0	23 07 18.9	-21 23 23
μ Ps A	4.6	A2	22 06 03.3	-33 11 05	ι Gru	4.1	K0	23 08 06.1	-45 27 50
θ Peg	3.7	A2	22 08 10.9	+ 6 00 01	7 And	4.6	F0	23 10 42.6	+49 11 15
π Peg	4.4	F5	22 08 12.5	+32 58 52	φ Aqr	4.4	M0	23 12 15.0	- 6 15 54
ζ Cep	3.6	K0	22 09 27.8	+58 00 13	ψ ¹ Aqr	4.5	K0	23 13 47.8	- 9 18 22
1 H. Lac	4.6	K2	22 12 09.5	+39 30 57	γ Tuc	4.1	F2	23 15 06.4	-58 27 19
ε Cep	4.2	F0	22 13 33.5	+56 50 37	γ Psc	3.8	K0	23 15 05.4	+ 3 03 48
1 Lac	4.2	K0	22 14 13.3	+37 32 56	93 Aqr	4.6	B5	23 15 49.5	- 9 24 04
θ Aqr	4.3	K0	22 14 43.4	- 7 58 59	γ Scl	4.5	K0	23 16 40.1	-32 45 01
α Tuc	2.9	K2	22 15 46.7	-60 27 35	τ Peg	4.6	A5	23 18 39.2	+23 31 16
2 Lac	4.7	B5	22 19 22.1	+46 20 05	98 Aqr	4.2	K0	23 20 52.2	-20 19 09
γ Aqr	4.0	A0	22 19 35.4	- 1 35 22	ν Peg	4.6	G0	23 23 22.7	+23 11 01
β Lac	4.6	K0	22 21 58.9	+52 01 41	99 Aqr	4.5	K5	23 23 56.8	-20 51 41
4 Lac	4.6	B8p	22 22 53.4	+49 16 23	θ Psc	4.4	G5	23 25 56.2	+ 6 09 32
π Aqr	4.6	B1p	22 23 14.0	+ 1 10 25	70 Peg	4.7	K0	23 27 07.7	+12 32 23
ζ Aqr	4.4	F2	22 26 46.4	- 0 13 32	β Scl	4.5	B9	23 30 49.8	-38 02 24
δ ¹ Gru	4.0	G5	22 26 53.1	-43 42 03	λ And	4.0	K0	23 35 35.9	+46 14 29
δ ² Gru	4.3	M4	22 27 22.5	-43 57 17	ι And	4.3	B8	23 36 10.0	+43 02 47
δ Cep	3-4	F5-G0	22 27 40.8	+58 12 36	γ Cep	3.4	K0	23 37 41.2	+77 24 33
5 Lac	4.6	K0, A0	22 27 51.6	+47 30 06	ι Psc	4.3	F8	23 37 53.5	+ 5 24 34
6 Lac	4.5	B3	22 28 45.4	+42 55 04	κ And	4.3	A0	23 38 25.8	+44 06 44
β Ps A	4.4	A0	22 29 14.1	-32 33 06	λ Psc	4.6	A5	23 40 00.2	+ 1 33 36
α Lac	3.8	A0	22 29 38.3	+50 04 35	ω ² Aqr	4.6	A0	23 40 38.9	-14 45 59
η Aqr	4.1	B8	22 33 18.0	- 0 19 27	δ Scl	4.6	A0	23 46 50.7	-28 21 06
ε Ps A	4.2	B8	22 38 26.8	-27 15 10	ρ Cas	4-5	F8p	23 52 22.4	+57 16 37
11 Lac	4.6	K0	22 38 45.3	+44 04 01	ψ Peg	4.7	M0	23 55 42.9	+24 55 09
ζ Peg	3.6	B8	22 39 27.9	+10 37 19	ω Psc	4.0	F5	23 57 15.3	+ 6 38 31
β Gru	2.2	M3	22 40 17.2	-47 05 40	ε Tuc	4.7	B9	23 57 51.1	-65 47 59
η Peg	3.1	G0	22 41 07.4	+30 00 42	θ Oct	4.7	K0	23 59 34.0	-77 17 11
β Oct	4.3	F0	22 42 05.5	-81 35 32	30 Psc	4.7	M3	23 59 54.5	- 6 14 11

There will be four eclipses, two of the Sun and two of the Moon.

I March 13	Total eclipse of the Moon
II March 27	Partial eclipse of the Sun
III September 5	Total eclipse of the Moon
IV September 20-21	Partial eclipse of the Sun

A correction of $-0''.5$ has been applied to the tabular latitude of the Moon. This correction is given below in the form of corrections to the right ascension and declination of the Moon.

	d	$\Delta\alpha$	$\Delta\delta$
March	13	$-0''.20$	$-0''.46$
March	27	$+0''.20$	$-0''.46$
September	5	$+0''.19$	$-0''.46$
September	20-21	$-0''.20$	$-0''.46$

The arguments are given in Ephemeris Time. The hour angle μ and the longitudes are referred to the ephemeris meridian. Once the value of ΔT is known, the data on these pages may be expressed in terms of Universal Time in the following manner:

Convert all arguments into Universal Time by the relation $U.T. = E.T. - \Delta T$.

Apply the correction $-1.0027 \Delta T$ to μ and to the longitudes, in order to refer them to the meridian of Greenwich, remembering that a second of time is equivalent to 15 seconds of arc.

Leave all other quantities unchanged.

I.—*Total Eclipse of the Moon*, March 13; the beginning visible in North America, South America, the Pacific Ocean except the southwestern part, the northeastern tip of Asia, the Atlantic Ocean except the southeastern part, the west coasts of Europe and of North Africa, and parts of Antarctica; the end visible in North America except the northeastern part, the western half of South America, the Pacific Ocean, Australia except the west coast, New Zealand, the east coast of Asia, and parts of Antarctica.

ELEMENTS OF THE ECLIPSE

E.T. of opposition in right ascension, March 13^d 08^h 34^m 38^s.73

	h	m	s		s
R.A. of Sun	23	33	29.255	Hourly motion	9.167
R.A. of Moon	11	33	29.255	Hourly motion	127.894
Declination of Sun	-2	51	54.87	Hourly motion	+ 0 59.08
Declination of Moon	+2	41	03.63	Hourly motion	-10 22.42
Equatorial hor. par. of Sun			8.85	True semidiameter of Sun	16 05.3
Equatorial hor. par. of Moon	57	29.62		True semidiameter of Moon	15 39.2

Total Eclipse of the Moon, March 13 (continued)

CIRCUMSTANCES OF THE ECLIPSE

		d	h	m	
Moon enters penumbra	March	13	05	34.3	} E.T.
Moon enters umbra		13	06	38.4	
Total eclipse begins		13	07	41.0	
Middle of the eclipse		13	08	28.3	
Total eclipse ends		13	09	15.7	
Moon leaves umbra		13	10	18.3	
Moon leaves penumbra		13	11	22.2	

		The Moon being in the Zenith	
Contacts of Umbra with Limb of Moon	Position Angles from the North Point	in Ephemeris Longitude	and in Latitude
First	97° to E.	+ 98° 09'	+3° 01'
Last	62° to W.	+151° 20'	+2° 23'

Magnitude of the eclipse 1.520

II.—*Partial Eclipse of the Sun, March 27.*

ELEMENTS OF THE ECLIPSE

E.T. of conjunction in right ascension, March 27^d 06^h 43^m 56^s.15

	h	m	s		s
R.A. of Sun and Moon	0	24	16.449	Hourly motions	9.099 and 124.987
Declination of Sun	+2°	37'	28.44"	Hourly motion	+ 0° 58' 72"
Declination of Moon	+1°	28'	46.13"	Hourly motion	+10° 14.06'
Equatorial hor. par. of Sun			8.82	True semidiameter of Sun	16 01.4
Equatorial hor. par. of Moon	56	52.52		True semidiameter of Moon	15 29.1

CIRCUMSTANCES OF THE ECLIPSE

	E.T.	Ephemeris Longitude	Latitude
	d h m	° '	° '
Eclipse begins	March 27 05 28.8	— 14 58	—65 42
Greatest eclipse	27 07 25.1	—151 49	—72 15
Eclipse ends	27 09 21.8	—129 20	—30 22

Magnitude of greatest eclipse 0.705

III.—*Total Eclipse of the Moon, September 5; the beginning visible in North America except the extreme northeastern part, the western half of South America, the Pacific Ocean, Australia except the west coast, New Zealand, the extreme northeastern coast of Asia, and parts of Antarctica; the end visible in Australia, New Zealand, Asia except the western part, the eastern part of the Indian Ocean, the Pacific Ocean, the west coast of North America, and parts of Antarctica.*

Total Eclipse of the Moon, September 5 (continued)

ELEMENTS OF THE ECLIPSE

E.T. of opposition in right ascension, September 5^d 11^h 29^m 37^s.48

	h	m	s		s
R.A. of Sun	10	56	54.343	Hourly motion	9.019
R.A. of Moon	22	56	54.343	Hourly motion	137.951
Declination of Sun	+6	43	21.01	Hourly motion	- 0 55.68
Declination of Moon	-6	28	18.98	Hourly motion	+10 37.57
Equatorial hor. par. of Sun			8.73	True semidiameter of Sun	15 52.0
Equatorial hor. par. of Moon	59	27.96		True semidiameter of Moon	16 11.4

CIRCUMSTANCES OF THE ECLIPSE

	d	h	m	
Moon enters penumbra	September	5	08	37.0
Moon enters umbra		5	09	36.1
Total eclipse begins		5	10	38.1
Middle of the eclipse		5	11	21.8
Total eclipse ends		5	12	05.6
Moon leaves umbra		5	13	07.5
Moon leaves penumbra		5	14	06.7

E.T.

Contacts of Umbra with Limb of Moon	Position Angles from the North Point	The Moon being in the Zenith	
		In Ephemeris Longitude	and In Latitude
First	87° to E.	+145° 22'	-6° 48'
Last	121° to W.	-163° 38'	-6° 11'

Magnitude of the eclipse 1.431

IV.—*Partial Eclipse of the Sun, September 20–21.*

ELEMENTS OF THE ECLIPSE

E.T. of conjunction in right ascension, September 20^d 22^h 15^m 58^s.36

	h	m	s		s
R.A. of Sun and Moon	11	52	24.440	Hourly motions	8.977 and 123.205
Declination of Sun	+ 0	49	22.41	Hourly motion	- 0 58.34
Declination of Moon	+ 2	00	44.93	Hourly motion	-10 09.93
Equatorial hor. par. of Sun			8.77	True semidiameter of Sun	15 55.9
Equatorial hor. par. of Moon	56	28.88		True semidiameter of Moon	15 22.7

CIRCUMSTANCES OF THE ECLIPSE

	E.T.	Ephemeris Longitude	Latitude
	d h m	° '	° '
Eclipse begins	September 20 21 09.5	-128 45	+68 56
Greatest eclipse	20 22 59.9	+ 74 09	+72 11
Eclipse ends	21 00 50.5	+103 49	+33 06

Magnitude of greatest eclipse 0.614

BESSELIAN ELEMENTS OF THE PARTIAL ECLIPSE OF THE SUN MARCH 27

E.T.		Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane
		<i>x</i>	<i>y</i>	<i>sin d</i>	<i>cos d</i>	<i>μ</i>	Penumbra
5	h m					° ' "	
	20	-0.714257	-1.438537	+0.045455	0.998966	258 37 35.8	0.555203
	30	0.629162	1.411448	.045501	.998964	261 07 38.5	.555230
	40	0.544067	1.384356	.045547	.998962	263 37 41.1	.555256
	50	0.458972	1.357262	.045594	.998960	266 07 43.8	.555281
6	00	-0.373876	-1.330166	+0.045640	0.998958	268 37 46.4	0.555306
	10	0.288780	1.303068	.045686	.998956	271 07 49.0	.555330
	20	0.203683	1.275969	.045732	.998954	273 37 51.7	.555353
	30	0.118588	1.248868	.045779	.998952	276 07 54.3	.555376
	40	-0.033492	1.221765	.045825	.998949	278 37 57.0	.555398
	50	+0.051602	1.194660	.045871	.998947	281 07 59.6	.555420
7	00	+0.136696	-1.167554	+0.045917	0.998945	283 38 02.3	0.555441
	10	0.221789	1.140445	.045964	.998943	286 08 04.9	.555461
	20	0.306880	1.113335	.046010	.998941	288 38 07.6	.555481
	30	0.391969	1.086223	.046056	.998939	291 08 10.2	.555500
	40	0.477057	1.059110	.046102	.998937	293 38 12.8	.555519
	50	0.562143	1.031995	.046148	.998935	296 08 15.5	.555537
8	00	+0.647227	-1.004878	+0.046195	0.998932	298 38 18.1	0.555554
	10	0.732310	0.977761	.046241	.998930	301 08 20.8	.555571
	20	0.817390	0.950642	.046287	.998928	303 38 23.4	.555587
	30	0.902467	0.923521	.046333	.998926	306 08 26.0	.555602
	40	0.987542	0.896399	.046380	.998924	308 38 28.7	.555617
	50	1.072615	0.869276	.046426	.998922	311 08 31.3	.555631
9	00	+1.157684	-0.842152	+0.046472	0.998920	313 38 34.0	0.555645
	10	1.242750	0.815027	.046518	.998917	316 08 36.6	.555658
	20	1.327813	0.787901	.046565	.998915	318 38 39.3	.555671
	30	+1.412872	-0.760774	+0.046611	0.998913	321 08 41.9	0.555683

$\tan f_1$ 0.004685
 μ' 0.261876 radians per hour

50° 60° 70° 80° 90° 100° 110° 120°

Longitude East of Greenwich

130° 140° 150° 160° 170° 180° 90° West of Greenwich

30° Longitude 40° 50° 60° 70° 80° 90° 100° 110° 120°

Latitude South of Equator

INDIAN OCEAN

AUSTRALIA

PACIFIC OCEAN

ANTARCTICA

Legend:

- Semiduration
- Middle of Eclipse

Ephemeris Time is used.

Key locations and events marked on the map:

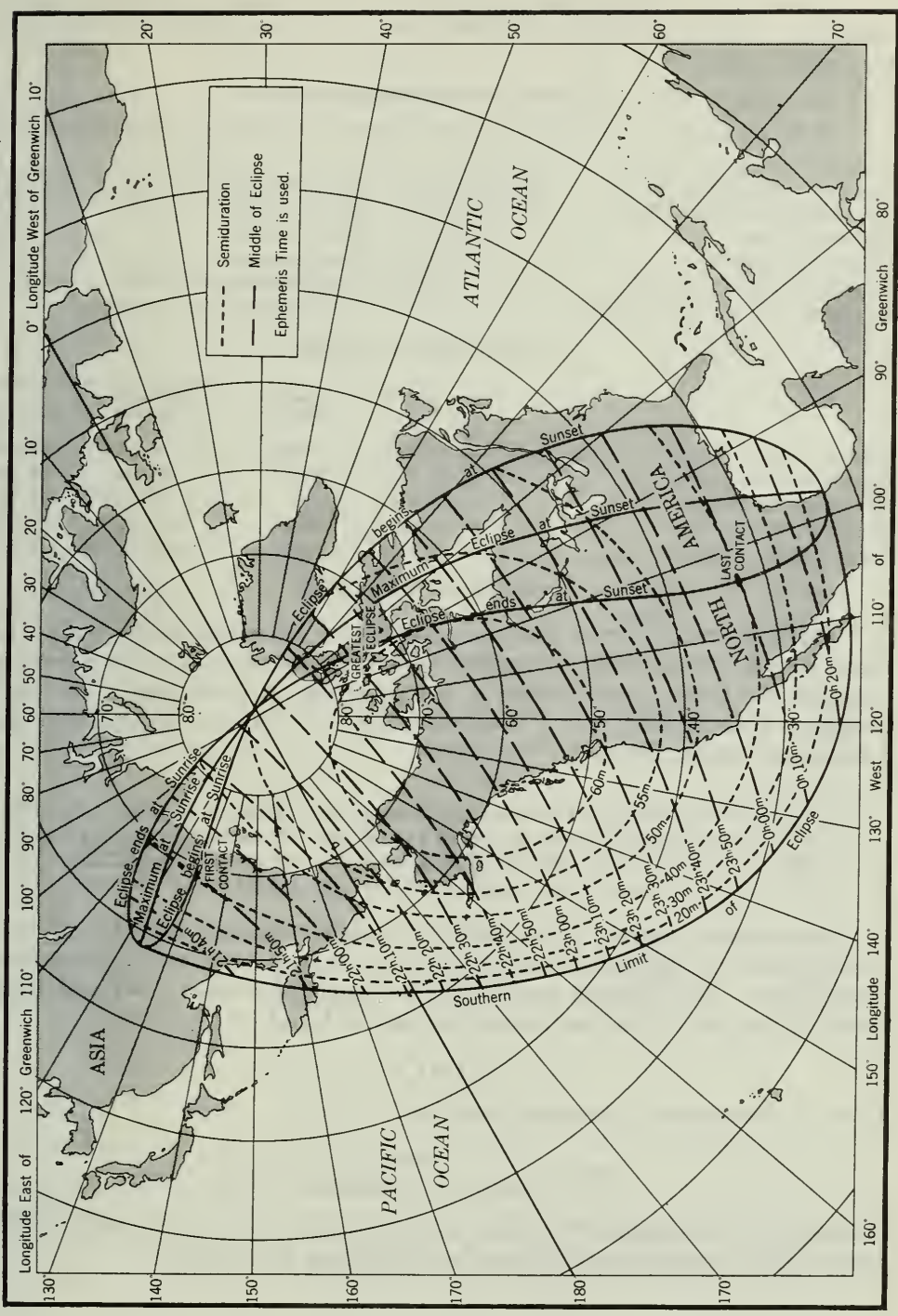
- Perth
- First Contact
- Maximum
- Eclipse begins
- Eclipse ends
- Greatest Eclipse
- Last Contact
- Antarctica

BESSELIAN ELEMENTS OF THE PARTIAL ECLIPSE OF THE SUN SEPTEMBER 20-21

E. T.		Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane
		<i>x</i>	<i>y</i>	sin <i>d</i>	cos <i>d</i>	<i>μ</i>	Penumbra
h	m					° ' "	
21	00	-0.641458	+1.474077	+0.014657	0.999893	136 41 24.4	0.555836
	10	0.557030	1.446825	.014611	.999893	139 11 27.4	.555825
	20	0.472601	1.419569	.014565	.999894	141 41 30.3	.555812
	30	0.388170	1.392309	.014519	.999895	144 11 33.2	.555799
	40	0.303737	1.365045	.014473	.999895	146 41 36.2	.555786
	50	0.219303	1.337777	.014427	.999896	149 11 39.1	.555772
22	00	-0.134868	+1.310505	+0.014381	0.999897	151 41 42.0	0.555757
	10	-0.050432	1.283230	.014335	.999897	154 11 45.0	.555742
	20	+0.034006	1.255951	.014289	.999898	156 41 47.9	.555726
	30	0.118444	1.228669	.014243	.999899	159 11 50.9	.555709
	40	0.202882	1.201384	.014197	.999899	161 41 53.8	.555692
	50	0.287320	1.174094	.014151	.999900	164 11 56.7	.555674
23	00	+0.371758	+1.146801	+0.014105	0.999901	166 41 59.7	0.555656
	10	0.456195	1.119505	.014059	.999901	169 12 02.6	.555637
	20	0.540632	1.092205	.014013	.999902	171 42 05.6	.555618
	30	0.625068	1.064901	.013967	.999902	174 12 08.5	.555598
	40	0.709504	1.037595	.013922	.999903	176 42 11.4	.555577
	50	0.793938	1.010284	.013876	.999904	179 12 14.4	.555556
0	00	+0.878372	+0.982971	+0.013830	0.999904	181 42 17.3	0.555534
	10	0.962804	0.955654	.013784	.999905	184 12 20.2	.555511
	20	1.047235	0.928334	.013738	.999906	186 42 23.2	.555488
	30	1.131665	0.901011	.013692	.999906	189 12 26.1	.555464
	40	1.216093	0.873685	.013646	.999907	191 42 29.1	.555440
	50	1.300519	0.846356	.013600	.999908	194 12 32.0	.555415
1	00	+1.384942	+0.819025	+0.013554	0.999908	196 42 34.9	0.555390

tan *f*₁ 0.004658
μ' 0.261885 radians per hour

PARTIAL SOLAR ECLIPSE OF SEPTEMBER 20-21, 1960



A transit of Mercury over the disk of the Sun will occur on November 7.

A correction of $-0''.90$ has been applied to the tabular true orbital longitude of Mercury, $+1''.20$ to the longitude of the node, and $+0.000\ 0026$ to the logarithm of the radius vector.

ELEMENTS OF THE TRANSIT

E.T. of conjunction in apparent geocentric longitude, November 7^d 16^b 38^m 36^s.54

	°	'	''		'	''
Apparent longitude of Sun	225	16	33.15	Hourly motion	+2	30.59
Apparent longitude of Mercury	225	16	33.15	Hourly motion	-3	18.52
Latitude of Sun	-	0	00.61	Hourly motion	0	00.00
Latitude of Mercury	-	8	55.95	Hourly motion	+0	51.79
Equatorial hor. par. of Sun			8.88	True semidiameter of Sun	16	08.68
Equatorial hor. par. of Mercury			13.03	True semidiameter of Mercury	4.95	

GEOCENTRIC PHASES

	E.T.	Position Angle P	Mercury being in the Zenith in Ephemeris Longitude	Latitude
	d h m s	°	° '	° '
Ingress, exterior contact	Nov. 7 14 34 33.4	148.3	+ 42 34	-16 37
Ingress, interior contact	7 14 36 33.8	148.7	+ 43 04	-16 37
Least angular distance	7 16 53 35.2		+ 77 32	-16 33
Egress, interior contact	7 19 10 40.8	262.1	+112 01	-16 29
Egress, exterior contact	7 19 12 41.2	262.5	+112 31	-16 29

Least angular distance $8'48''.1$

The Universal Times of the four contacts for any point on the surface of the Earth may be computed from the four following formulae, in which ρ denotes the radius of the Earth at that point, ϕ' the geocentric latitude, and λ the longitude west from Greenwich; T^I and T^{II} are respectively the times of exterior and interior contacts at ingress, T^{III} and T^{IV} at egress.

$$\begin{aligned}
 T^I &= 14\ 34\ 33.4 + 41.17\ \rho \sin \phi' - 29.30\ \rho \cos \phi' \cos (72\ 14.8 + \lambda + 1.0027\Delta T) - \Delta T \\
 T^{II} &= 14\ 36\ 33.8 + 41.51\ \rho \sin \phi' - 29.19\ \rho \cos \phi' \cos (72\ 04.3 + \lambda + 1.0027\Delta T) - \Delta T \\
 T^{III} &= 19\ 10\ 40.8 - 6.55\ \rho \sin \phi' + 50.04\ \rho \cos \phi' \cos (155\ 46.4 + \lambda + 1.0027\Delta T) - \Delta T \\
 T^{IV} &= 19\ 12\ 41.2 - 6.20\ \rho \sin \phi' + 49.87\ \rho \cos \phi' \cos (155\ 22.8 + \lambda + 1.0027\Delta T) - \Delta T
 \end{aligned}$$

The position angle P of the point of contact, reckoned from the north point of the limb of the Sun toward the east, may be taken as equal to its geocentric value given above. The position angle V of the point of contact, reckoned from the vertex of the limb of the Sun toward the east, is found by

$$V = P - C,$$

where C , the parallactic angle, is given by

$$\tan C = \frac{\cos \phi \sin h}{\sin \phi \cos \delta - \cos \phi \sin \delta \cos h},$$

in which ϕ is the latitude of the place, δ is the declination of the Sun and h is the local hour angle of the Sun; $\sin C$ has the same algebraic sign as $\sin h$.

Accurate local circumstances may be calculated as follows.

Let the quantities u , u' , v , v' and L be expressed in the form

$$A + B\rho \sin \phi' + \rho \cos \phi' (C \sin t + D \cos t),$$

where A , B , C , D and t are tabulated below, with subscripts 1, 2, 3, 4 for the four contacts.

Let T_0 be the Ephemeris Time of geocentric contact. The corresponding Universal Time T of local contact will be given by

$$T = T_0 + \tau - \Delta T,$$

where

$$\tau = 3600 \left[\frac{L \cos \psi}{n} - \frac{uu' + vv'}{n^2} \right],$$

$$n^2 = u'^2 + v'^2,$$

$$\sin \psi = \frac{1}{nL} (uv' - u'v);$$

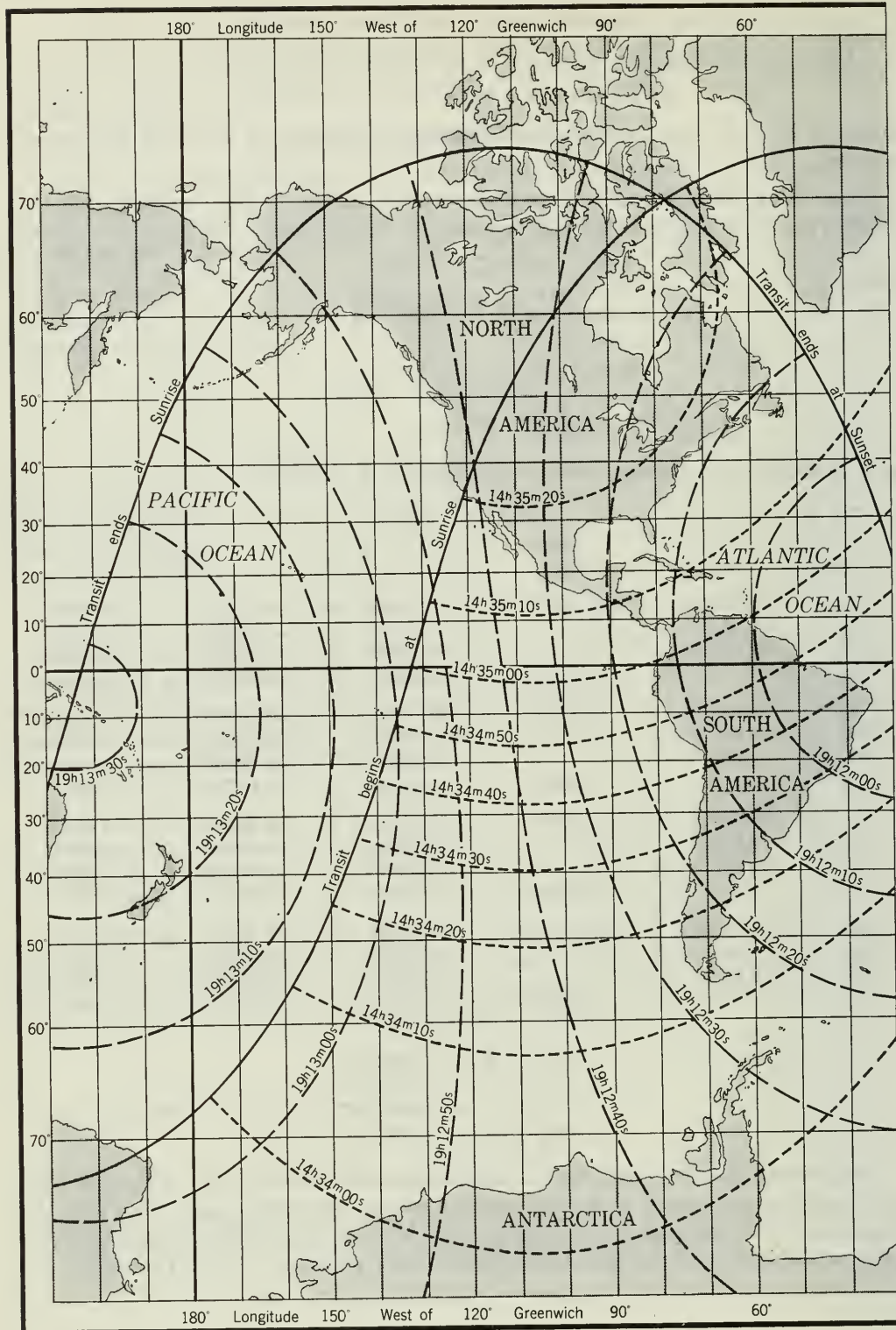
$\cos \psi$ is negative for ingress, positive for egress; τ is in seconds.

	u	u'	v	v'	L
A_1	+6.65803	-0.53302	-7.58203	+3.61518	+10.09042
B_1	+0.03951	0	-0.01207	+0.00001	+ 0.00006
C_1	-0.01713	0	-0.02784	-0.00800	+ 0.00013
D_1	0	-0.00450	+0.03056	-0.00729	+ 0.00014
A_2	+6.64020	-0.53304	-7.46114	+3.61530	+ 9.98804
B_2	+0.03951	0	-0.01207	+0.00001	+ 0.00006
C_2	-0.01713	0	-0.02784	-0.00800	+ 0.00013
D_2	0	-0.00450	+0.03056	-0.00729	+ 0.00014
A_3	+4.19930	-0.53547	+9.09184	+3.63106	+10.01478
B_3	+0.03951	0	-0.01203	+0.00001	+ 0.00006
C_3	-0.01713	0	-0.02775	-0.00803	+ 0.00013
D_3	0	-0.00450	+0.03066	-0.00726	+ 0.00014
A_4	+4.18139	-0.53549	+9.21327	+3.63118	+10.11774
B_4	+0.03951	0	-0.01203	+0.00001	+ 0.00006
C_4	-0.01713	0	-0.02775	-0.00803	+ 0.00013
D_4	0	-0.00450	+0.03066	-0.00726	+ 0.00014

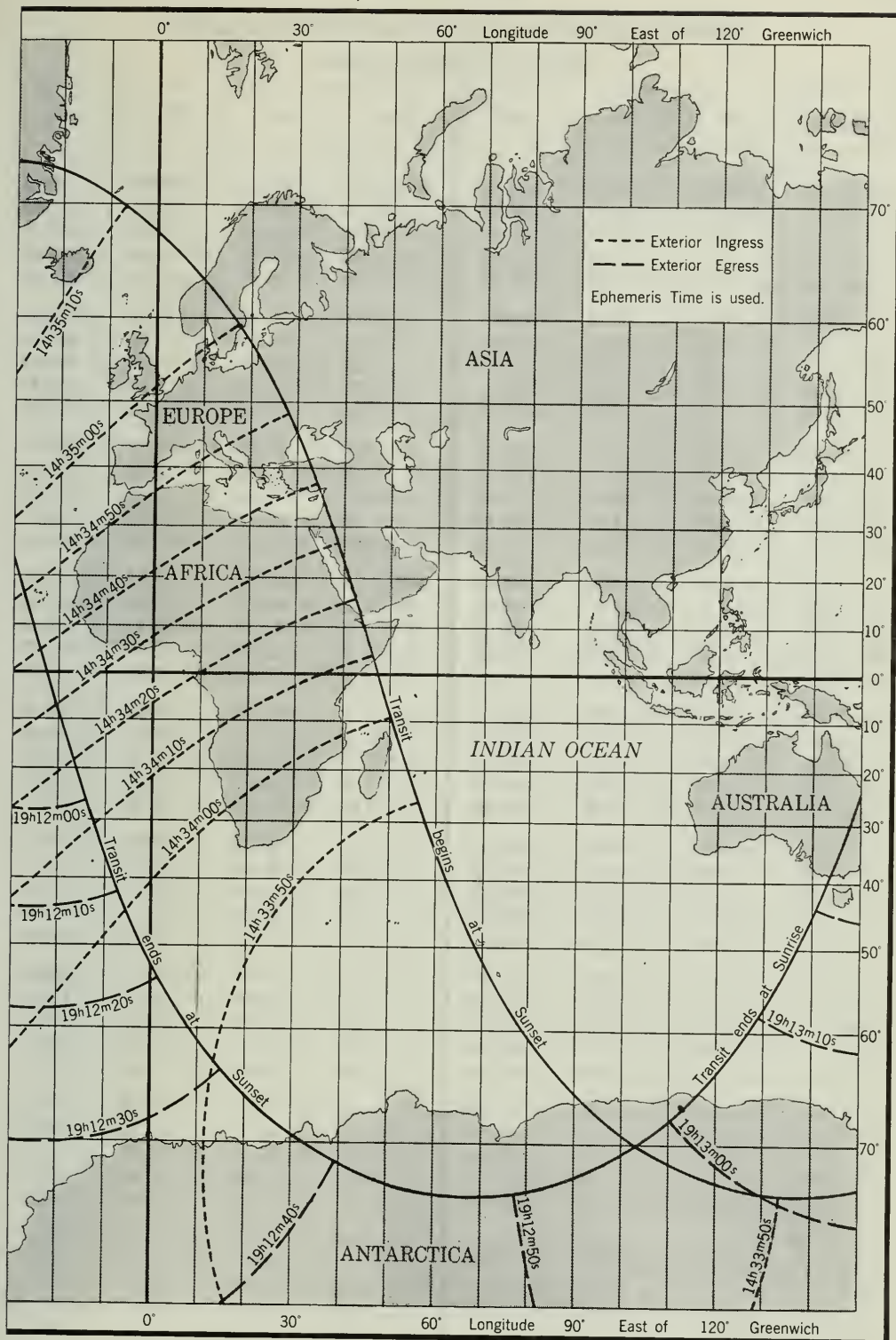
$$\begin{aligned} t_1 &= 265 \ 25.9 - \lambda - 1.0027 \ \Delta T \\ t_2 &= 265 \ 56.1 - \lambda - 1.0027 \ \Delta T \\ t_3 &= 334 \ 39.1 - \lambda - 1.0027 \ \Delta T \\ t_4 &= 335 \ 09.3 - \lambda - 1.0027 \ \Delta T \end{aligned}$$

In general, the times of local contacts computed with this table will differ very little from those obtained with the formulae on the preceding page. However, for transits in which the least angular distance of Mercury and the Sun is almost equal to the semidiameter of the Sun, the difference may amount to several seconds.

TRANSIT OF MERCURY,



NOVEMBER 7, 1960



EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Jan. 0	+ 2.97	-2.87	255.53	Feb. 15	-17.15	-6.82	9.82
1	2.49	2.99	242.36	16	17.49	6.86	356.65
2	2.00	3.10	229.19	17	17.82	6.90	343.48
3	1.51	3.22	216.02	18	18.15	6.94	330.32
4	1.02	3.33	202.85	19	18.47	6.97	317.15
5	+ 0.54	-3.45	189.68	20	-18.78	-7.01	303.98
6	+ 0.06	3.56	176.51	21	19.09	7.04	290.81
7	- 0.43	3.67	163.34	22	19.40	7.07	277.64
8	0.92	3.78	150.17	23	19.70	7.10	264.47
9	1.40	3.89	137.00	24	19.99	7.12	251.30
10	- 1.88	-4.00	123.83	25	-20.28	-7.14	238.13
11	2.36	4.11	110.66	26	20.56	7.16	224.96
12	2.84	4.21	97.49	27	20.83	7.18	211.79
13	3.32	4.32	84.33	28	21.10	7.20	198.61
14	3.79	4.42	71.16	29	21.36	7.22	185.44
15	- 4.27	-4.52	57.99	Mar. 1	-21.62	-7.22	172.27
16	4.74	4.62	44.82	2	21.87	7.23	159.10
17	5.21	4.72	31.65	3	22.11	7.24	145.93
18	5.67	4.82	18.49	4	22.34	7.25	132.75
19	6.14	4.91	5.32	5	22.57	7.25	119.58
20	- 6.60	-5.00	352.15	6	-22.80	-7.25	106.40
21	7.05	5.10	338.99	7	23.01	7.25	93.23
22	7.51	5.19	325.82	8	23.22	7.24	80.05
23	7.96	5.28	312.65	9	23.43	7.24	66.87
24	8.40	5.36	299.49	10	23.63	7.23	53.70
25	- 8.85	-5.45	286.32	11	-23.82	-7.22	40.52
26	9.29	5.53	273.15	12	24.00	7.21	27.34
27	9.72	5.62	259.99	13	24.18	7.19	14.16
28	10.16	5.70	246.82	14	24.35	7.17	0.98
29	10.59	5.78	233.66	15	24.51	7.16	347.80
30	-11.01	-5.85	220.49	16	-24.67	-7.14	334.62
31	11.43	5.93	207.32	17	24.82	7.11	321.44
Feb. 1	11.85	6.00	194.16	18	24.96	7.09	308.25
2	12.26	6.07	180.99	19	25.10	7.06	295.07
3	12.66	6.14	167.83	20	25.23	7.03	281.89
4	-13.06	-6.21	154.66	21	-25.35	-7.00	268.70
5	13.46	6.27	141.49	22	25.47	6.96	255.52
6	13.85	6.34	128.33	23	25.58	6.93	242.33
7	14.24	6.40	115.16	24	25.68	6.89	229.14
8	14.62	6.46	101.99	25	25.77	6.85	215.96
9	-15.00	-6.52	88.83	26	-25.86	-6.80	202.77
10	15.37	6.57	75.66	27	25.94	6.76	189.58
11	15.74	6.62	62.49	28	26.02	6.71	176.39
12	16.10	6.67	49.32	29	26.08	6.67	163.20
13	16.45	6.72	36.16	30	26.14	6.62	150.01
14	-16.80	-6.77	22.99	31	-26.19	-6.56	136.82
15	-17.15	-6.82	9.82	Apr. 1	-26.24	-6.51	123.63

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Apr. 1	-26.24	-6.51	123.63	May 17	-20.46	-2.37	235.92
2	26.28	6.45	110.44	18	20.17	2.25	222.69
3	26.31	6.40	97.24	19	19.87	2.14	209.46
4	26.33	6.34	84.05	20	19.56	2.02	196.23
5	26.35	6.27	70.85	21	19.25	1.90	183.00
6	-26.36	-6.21	57.65	22	-18.94	-1.79	169.78
7	26.36	6.14	44.46	23	18.62	1.67	156.55
8	26.35	6.08	31.26	24	18.29	1.55	143.32
9	26.34	6.01	18.06	25	17.95	1.43	130.09
10	26.32	5.94	4.86	26	17.61	1.31	116.85
11	-26.29	-5.87	351.66	27	-17.27	-1.19	103.62
12	26.26	5.79	338.46	28	16.92	1.07	90.39
13	26.22	5.71	325.25	29	16.56	0.95	77.16
14	26.17	5.64	312.05	30	16.20	0.83	63.93
15	26.11	5.56	298.84	31	15.83	0.71	50.69
16	-26.04	-5.48	285.64	June 1	-15.46	-0.59	37.46
17	25.97	5.40	272.43	2	15.09	0.47	24.22
18	25.89	5.32	259.23	3	14.71	0.35	10.99
19	25.81	5.23	246.02	4	14.32	0.23	357.76
20	25.71	5.14	232.81	5	13.93	-0.11	344.52
21	-25.61	-5.06	219.60	6	-13.54	+0.01	331.28
22	25.50	4.97	206.39	7	13.14	0.13	318.05
23	25.39	4.88	193.18	8	12.73	0.25	304.81
24	25.26	4.79	179.97	9	12.33	0.37	291.58
25	25.13	4.69	166.76	10	11.92	0.49	278.34
26	-25.00	-4.60	153.55	11	-11.50	+0.61	265.10
27	24.85	4.50	140.34	12	11.08	0.73	251.87
28	24.70	4.41	127.12	13	10.66	0.85	238.63
29	24.54	4.31	113.91	14	10.24	0.97	225.39
30	24.37	4.21	100.69	15	9.81	1.09	212.16
May 1	-24.20	-4.11	87.48	16	- 9.38	+1.21	198.92
2	24.02	4.01	74.26	17	8.95	1.33	185.68
3	23.83	3.90	61.04	18	8.51	1.45	172.45
4	23.63	3.80	47.82	19	8.08	1.57	159.21
5	23.43	3.69	34.60	20	7.64	1.68	145.97
6	-23.22	-3.59	21.38	21	- 7.19	+1.80	132.74
7	23.00	3.48	8.16	22	6.75	1.92	119.50
8	22.78	3.37	354.94	23	6.30	2.03	106.26
9	22.55	3.26	341.72	24	5.85	2.15	93.03
10	22.31	3.16	328.49	25	5.40	2.26	79.79
11	-22.06	-3.05	315.27	26	- 4.95	+2.38	66.55
12	21.81	2.93	302.05	27	4.50	2.49	53.32
13	21.55	2.82	288.82	28	4.04	2.60	40.08
14	21.29	2.71	275.60	29	3.59	2.71	26.84
15	21.02	2.60	262.37	30	3.14	2.83	13.61
16	-20.74	-2.48	249.14	July 1	- 2.69	+2.94	0.37
17	-20.46	-2.37	235.92	2	- 2.23	+3.05	347.14

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
July 1	- 2.69	+2.94	0.37	Aug. 16	+16.39	+6.71	111.86
2	2.23	3.05	347.14	17	16.72	6.76	98.64
3	1.78	3.16	333.90	18	17.05	6.80	85.43
4	1.32	3.26	320.66	19	17.38	6.84	72.21
5	0.87	3.37	307.43	20	17.70	6.88	59.00
6	- 0.41	+3.48	294.19	21	+18.01	+6.92	45.78
7	+ 0.04	3.58	280.96	22	18.32	6.96	32.56
8	0.50	3.69	267.72	23	18.63	6.99	19.35
9	0.95	3.79	254.49	24	18.93	7.02	6.14
10	1.40	3.89	241.25	25	19.22	7.05	352.93
11	+ 1.85	+3.99	228.02	26	+19.51	+7.08	339.71
12	2.30	4.09	214.78	27	19.79	7.10	326.50
13	2.75	4.19	201.55	28	20.07	7.13	313.29
14	3.20	4.29	188.32	29	20.35	7.15	300.08
15	3.64	4.39	175.08	30	20.61	7.17	286.87
16	+ 4.08	+4.48	161.85	31	+20.87	+7.18	273.66
17	4.53	4.58	148.62	Sept. 1	21.13	7.20	260.45
18	4.97	4.67	135.39	2	21.38	7.21	247.24
19	5.40	4.76	122.16	3	21.63	7.22	234.03
20	5.84	4.85	108.92	4	21.87	7.23	220.82
21	+ 6.27	+4.94	95.69	5	+22.10	+7.24	207.62
22	6.70	5.03	82.46	6	22.33	7.25	194.41
23	7.13	5.11	69.23	7	22.56	7.25	181.20
24	7.56	5.20	56.01	8	22.77	7.25	168.00
25	7.98	5.28	42.78	9	22.98	7.25	154.79
26	+ 8.40	+5.36	29.55	10	+23.19	+7.24	141.59
27	8.82	5.44	16.32	11	23.39	7.24	128.38
28	9.23	5.52	3.09	12	23.58	7.23	115.18
29	9.64	5.60	349.87	13	23.77	7.22	101.97
30	10.05	5.68	336.64	14	23.95	7.21	88.77
31	+10.46	+5.75	323.41	15	+24.12	+7.20	75.57
Aug. 1	10.86	5.82	310.19	16	24.29	7.18	62.37
2	11.25	5.90	296.96	17	24.46	7.16	49.17
3	11.65	5.97	283.74	18	24.61	7.14	35.97
4	12.04	6.03	270.51	19	24.76	7.12	22.77
5	+12.42	+6.10	257.29	20	+24.90	+7.09	9.57
6	12.80	6.16	244.07	21	25.04	7.07	356.37
7	13.18	6.23	230.84	22	25.17	7.04	343.17
8	13.56	6.29	217.62	23	25.30	7.01	329.97
9	13.93	6.35	204.40	24	25.42	6.98	316.77
10	+14.29	+6.41	191.18	25	+25.53	+6.94	303.57
11	14.65	6.46	177.96	26	25.63	6.90	290.38
12	15.01	6.52	164.74	27	25.73	6.87	277.18
13	15.36	6.57	151.52	28	25.82	6.83	263.98
14	15.71	6.62	138.30	29	25.90	6.79	250.79
15	+16.05	+6.67	125.08	30	+25.98	+6.74	237.59
16	+16.39	+6.71	111.86	Oct. 1	+26.05	+6.69	224.39

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Oct. 1	+26.05	+6.69	224.39	Nov. 16	+21.17	+2.66	337.73
2	26.11	6.64	211.20	17	20.88	2.54	324.55
3	26.17	6.59	198.00	18	20.58	2.42	311.36
4	26.22	6.54	184.81	19	20.28	2.30	298.18
5	26.26	6.48	171.62	20	19.97	2.18	285.00
6	+26.29	+6.42	158.42	21	+19.66	+2.06	271.82
7	26.32	6.37	145.23	22	19.33	1.93	258.64
8	26.34	6.31	132.03	23	19.00	1.81	245.46
9	26.35	6.24	118.84	24	18.66	1.69	232.28
10	26.36	6.18	105.65	25	18.32	1.56	219.10
11	+26.36	+6.11	92.46	26	+17.97	+1.44	205.92
12	26.35	6.04	79.26	27	17.61	1.31	192.74
13	26.33	5.97	66.07	28	17.25	1.19	179.56
14	26.31	5.90	52.88	29	16.88	1.06	166.38
15	26.27	5.83	39.69	30	16.50	0.93	153.20
16	+26.23	+5.75	26.50	Dec. 1	+16.12	+0.81	140.02
17	26.19	5.68	13.31	2	15.73	0.68	126.85
18	26.13	5.60	0.12	3	15.34	0.55	113.67
19	26.07	5.52	346.93	4	14.94	0.42	100.49
20	26.00	5.43	333.74	5	14.53	0.30	87.31
21	+25.92	+5.35	320.55	6	+14.12	+0.17	74.14
22	25.84	5.26	307.37	7	13.70	+0.04	60.96
23	25.74	5.18	294.18	8	13.28	-0.09	47.78
24	25.64	5.09	280.99	9	12.85	0.22	34.60
25	25.54	5.00	267.80	10	12.42	0.34	21.43
26	+25.42	+4.90	254.61	11	+11.98	-0.47	8.25
27	25.30	4.81	241.43	12	11.54	0.60	355.07
28	25.16	4.71	228.24	13	11.10	0.73	341.90
29	25.02	4.62	215.05	14	10.65	0.86	328.72
30	24.88	4.52	201.87	15	10.20	0.98	315.55
31	+24.72	+4.42	188.68	16	+ 9.74	-1.11	302.37
Nov. 1	24.56	4.32	175.49	17	9.28	1.24	289.20
2	24.38	4.22	162.31	18	8.82	1.36	276.03
3	24.20	4.11	149.12	19	8.36	1.49	262.85
4	24.02	4.01	135.94	20	7.89	1.61	249.68
5	+23.82	+3.90	122.75	21	+ 7.42	-1.74	236.51
6	23.62	3.79	109.56	22	6.94	1.86	223.33
7	23.41	3.69	96.38	23	6.47	1.99	210.16
8	23.19	3.58	83.19	24	5.99	2.11	196.99
9	22.97	3.47	70.01	25	5.51	2.24	183.82
10	+22.73	+3.35	56.82	26	+ 5.03	-2.36	170.65
11	22.49	3.24	43.64	27	4.55	2.48	157.47
12	22.24	3.13	30.46	28	4.06	2.60	144.30
13	21.98	3.01	17.28	29	3.58	2.72	131.13
14	21.72	2.89	4.09	30	3.09	2.84	117.96
15	+21.45	+2.78	350.91	31	+ 2.61	-2.96	104.79
16	+21.17	+2.66	337.73	32	+ 2.12	-3.07	91.62

EPHEMERIS FOR PHYSICAL OBSERVATIONS

TABLE OF AMOUNT TO BE SUBTRACTED FROM L_0 AT 0^h U.T. TO OBTAIN THE VALUE OF L_0 AT ANY U.T.

U.T. h	Daily Motion								
	13.16	13.17	13.18	13.19	13.20	13.21	13.22	13.23	13.24
	°	°	°	°	°	°	°	°	°
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
2	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
3	1.64	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.66
4	2.19	2.20	2.20	2.20	2.20	2.20	2.20	2.21	2.21
5	2.74	2.74	2.75	2.75	2.75	2.75	2.75	2.76	2.76
6	3.29	3.29	3.30	3.30	3.30	3.30	3.30	3.31	3.31
7	3.84	3.84	3.84	3.85	3.85	3.85	3.86	3.86	3.86
8	4.39	4.39	4.39	4.40	4.40	4.40	4.41	4.41	4.41
9	4.93	4.94	4.94	4.95	4.95	4.95	4.96	4.96	4.97
10	5.48	5.49	5.49	5.50	5.50	5.50	5.51	5.51	5.52
11	6.03	6.04	6.04	6.05	6.05	6.05	6.06	6.06	6.07
12	6.58	6.59	6.59	6.59	6.60	6.61	6.61	6.62	6.62
13	7.13	7.13	7.14	7.14	7.15	7.16	7.16	7.17	7.17
14	7.68	7.68	7.69	7.69	7.70	7.71	7.71	7.72	7.72
15	8.22	8.23	8.24	8.24	8.25	8.26	8.26	8.27	8.28
16	8.77	8.78	8.79	8.79	8.80	8.81	8.81	8.82	8.83
17	9.32	9.33	9.34	9.34	9.35	9.36	9.36	9.37	9.38
18	9.87	9.88	9.89	9.89	9.90	9.91	9.91	9.92	9.93
19	10.42	10.43	10.43	10.44	10.45	10.46	10.47	10.47	10.48
20	10.97	10.98	10.98	10.99	11.00	11.01	11.02	11.03	11.03
21	11.51	11.52	11.53	11.54	11.55	11.56	11.57	11.58	11.59
22	12.06	12.07	12.08	12.09	12.10	12.11	12.12	12.13	12.14
23	12.61	12.62	12.63	12.64	12.65	12.66	12.67	12.68	12.69

The following critical table is to be used for all values of the daily motion.

^m	^m	^m	^m	^m	^m	^m
00.0 °	08.1 °	16.9 °	25.6 °	34.3 °	43.0 °	51.8 °
00.5 0.00	09.2 0.08	18.0 0.16	26.7 0.24	35.4 0.32	44.1 0.40	52.9 0.48
01.6 .01	10.3 .09	19.0 .17	27.8 .25	36.5 .33	45.2 .41	54.0 .49
02.7 .02	11.4 .10	20.1 .18	28.9 .26	37.6 .34	46.3 .42	55.0 .50
03.8 .03	12.5 .11	21.2 .19	30.0 .27	38.7 .35	47.4 .43	56.1 .51
04.9 .04	13.6 .12	22.3 .20	31.0 .28	39.8 .36	48.5 .44	57.2 .52
06.0 .05	14.7 .13	23.4 .21	32.1 .29	40.9 .37	49.6 .45	58.3 .53
07.0 .06	15.8 .14	24.5 .22	33.2 .30	42.0 .38	50.7 .46	59.4 .54
08.1 0.07	16.9 0.15	25.6 0.23	34.3 0.31	43.0 0.39	51.8 0.47	60.0 0.55

In critical cases ascend.

EPHEMERIS FOR PHYSICAL OBSERVATIONS

ROTATION NUMBERS AND DATES

Rotation No.	Date of commencement			Rotation No.	Date of commencement			Rotation No.	Date of commencement		
1316	1952	Jan.	22.96	1356	1955	Jan.	17.96	1396	1958	Jan.	12.96
1317		Feb.	19.30	1357		Feb.	14.30	1397		Feb.	9.30
1318		Mar.	17.63	1358		Mar.	13.63	1398		Mar.	8.63
1319		Apr.	13.92	1359		Apr.	9.93	1399		Apr.	4.94
1320		May	11.16	1360		May	7.18	1400		May	2.20
1321		June	7.37	1361		June	3.39	1401		May	29.41
				1362		June	30.59	1402		June	25.61
1322		July	4.57								
1323		July	31.78	1363		July	27.80	1403		July	22.82
1324		Aug.	28.01	1364		Aug.	24.03	1404		Aug.	19.04
1325		Sept.	24.28	1365		Sept.	20.28	1405		Sept.	15.30
1326		Oct.	21.56	1366		Oct.	17.57	1406		Oct.	12.57
1327		Nov.	17.87	1367		Nov.	13.87	1407		Nov.	8.87
1328		Dec.	15.18	1368		Dec.	11.18	1408		Dec.	6.19
1329	1953	Jan.	11.52	1369	1956	Jan.	7.51	1409	1959	Jan.	2.51
1330		Feb.	7.86	1370		Feb.	3.85	1410		Jan.	29.85
1331		Mar.	7.19	1371		Mar.	2.19	1411		Feb.	26.19
1332		Apr.	3.50	1372		Mar.	29.50	1412		Mar.	25.51
1333		Apr.	30.76	1373		Apr.	25.77	1413		Apr.	21.79
1334		May	27.98	1374		May	23.00	1414		May	19.02
1335		June	24.18	1375		June	19.20	1415		June	15.22
1336		July	21.38	1376		July	16.40	1416		July	12.42
1337		Aug.	17.60	1377		Aug.	12.62	1417		Aug.	8.64
1338		Sept.	13.86	1378		Sept.	8.87	1418		Sept.	4.88
1339		Oct.	11.13	1379		Oct.	6.14	1419		Oct.	2.15
1340		Nov.	7.43	1380		Nov.	2.44	1420		Oct.	29.44
1341		Dec.	4.74	1381		Nov.	29.75	1421		Nov.	25.75
				1382		Dec.	27.07	1422		Dec.	23.07
1342	1954	Jan.	1.07								
1343		Jan.	28.41	1383	1957	Jan.	23.41	1423	1960	Jan.	19.40
1344		Feb.	24.75	1384		Feb.	19.75	1424		Feb.	15.75
1345		Mar.	24.07	1385		Mar.	19.07	1425		Mar.	14.07
1346		Apr.	20.35	1386		Apr.	15.36	1426		Apr.	10.37
1347		May	17.58	1387		May	12.60	1427		May	7.62
1348		June	13.79	1388		June	8.81	1428		June	3.83
1349		July	10.98	1389		July	6.01	1429		July	1.03
1350		Aug.	7.20	1390		Aug.	2.21	1430		July	28.23
1351		Sept.	3.44	1391		Aug.	29.45	1431		Aug.	24.46
1352		Sept.	30.71	1392		Sept.	25.72	1432		Sept.	20.72
1353		Oct.	28.00	1393		Oct.	23.00	1433		Oct.	18.01
1354		Nov.	24.31	1394		Nov.	19.31	1434		Nov.	14.31
1355		Dec.	21.63	1395		Dec.	16.63	1435		Dec.	11.63

The synodic rotations are numbered in continuation of Carrington's Greenwich Photoheliographic series, of which No. 1 commenced on 1853 November 9.

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Frac- tion Illum.	
		Long.	Lat.	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb		
Jan.	d	°	°	(0°01)	°	°	°	°		
	0	1.2	+4.16	-5.79	0 +4 0	282.89	+1.47	349.01	245.4	0.02
	1	2.2	5.76	+1.60 4.83	0 4 0	295.08	1.47	343.61	-5.40 248.4	+3.0 0.07
	2	3.2	6.89	1.13 0.62	0 4 0	307.26	1.47	339.47	4.14 247.9	-0.5 0.14
	3	4.2	7.51	0.62 0.11	0 4 0	319.44	1.47	336.69	2.78 247.0	0.9 0.23
	4	5.2	7.62	+0.11 -0.33	0 4 0	331.61	1.47	335.27	1.42 246.6	-0.4 0.32
	5	6.2	+7.29	-0.33 0.48	0 +4 0	343.78	+1.47	335.11	-0.16 246.7	+0.1 0.42
	6	7.2	6.58	-0.71 0.98	0 4 0	355.94	1.48	336.10	+0.99 247.5	+0.8 0.52
	7	8.2	5.60	0.98 1.18	0 4 0	8.10	1.48	338.14	2.04 248.8	1.3 0.62
	8	9.2	4.42	1.18 1.28	0 4 0	20.24	1.48	341.10	2.96 250.6	1.8 0.71
	9	10.2	3.14	1.28 1.31	0 4 0	32.39	1.48	344.87	3.77 252.8	2.2 0.79
	10	11.2	+1.83	1.31 -1.31	0 +4 0	44.53	+1.48	349.31	4.44 255.1	2.3 0.86
	11	12.2	+0.52	-1.31 1.23	0 4 0	56.66	1.48	354.26	+4.95 257.0	+1.9 0.92
	12	13.2	-0.71	1.23 1.16	0 4 0	68.79	1.47	359.52	5.26 257.2	+0.2 0.96
	13	14.2	1.87	1.16 1.06	-1 4 -1	80.92	1.46	4.83	5.31 250.8	.. 0.99
	14	15.2	2.93	1.06 0.94	1 4 1	93.05	1.45	9.96	5.13 8.4	.. 1.00
	15	16.2	-3.87	0.94 -0.82	-1 +4 -1	105.18	+1.43	14.64	4.68 122.8	.. 0.99
	16	17.2	4.69	-0.82 0.69	1 4 1	117.31	1.41	18.64	+4.00 115.1	-7.7 0.96
	17	18.2	5.38	0.69 0.52	1 4 1	129.44	1.39	21.78	3.14 113.8	1.3 0.91
	18	19.2	5.90	0.52 0.34	1 4 1	141.58	1.36	23.91	2.13 113.6	0.2 0.85
	19	20.2	6.24	0.34 -0.09	1 4 1	153.72	1.34	24.90	+0.99 113.4	0.2 0.77
	20	21.2	-6.33	-0.09 +0.20	-1 +4 -1	165.86	+1.31	24.68	-0.22 112.8	0.6 0.67
	21	22.2	6.13	+0.20 0.52	1 4 1	178.01	1.28	23.18	-1.50 111.5	-1.3 0.57
	22	23.2	5.61	0.52 0.88	1 4 1	190.17	1.26	20.36	2.82 109.4	2.1 0.46
	23	24.2	4.73	0.88 1.23	1 4 1	202.34	1.24	16.26	4.10 106.6	2.8 0.35
	24	25.2	3.50	1.23 1.52	1 4 -1	214.51	1.21	11.00	5.26 103.3	3.3 0.24
	25	26.2	-1.98	1.52 -0.00	-1 +4 0	226.69	+1.19	4.85	6.15 99.7	3.6 0.15
	26	27.2	-0.25	-0.00 +1.73	1 4 0	238.88	1.17	358.26	-6.59 96.7	-3.0 0.07
	27	28.2	+1.54	+1.73 1.79	1 4 0	251.07	1.15	351.77	6.49 97.0	+0.3 0.02
	28	29.2	3.22	1.79 1.68	1 4 0	263.26	1.13	345.92	5.85 125.3	.. 0.00
	29	0.7	4.66	1.68 1.44	1 4 0	275.45	1.12	341.15	4.77 235.2	.. 0.01
30	1.7	+5.74	1.44 1.08	-1 +4 0	287.65	+1.10	337.72	3.43 244.4	.. 0.04	
Feb.	31	2.7	6.38	1.08 +0.64	1 4 0	299.83	1.09	335.69	-2.03 246.1	+1.7 0.10
	1	3.7	6.58	+0.64 -0.20	1 4 0	312.02	1.08	335.03	-0.66 246.9	0.8 0.17
	2	4.7	6.34	-0.20 -0.24	1 4 0	324.20	1.06	335.64	+0.61 248.0	1.1 0.25
	3	5.7	5.74	-0.24 0.60	1 4 0	336.38	1.05	337.37	1.73 249.6	1.6 0.35
	4	6.7	+4.85	0.60 0.89	-1 +4 0	348.55	+1.05	340.10	2.73 251.7	2.1 0.44
	5	7.7	3.74	0.89 -1.11	1 4 0	0.71	1.04	343.68	+3.58 254.3	+2.6 0.54
	6	8.7	2.50	-1.11 1.24	1 4 0	12.87	1.03	347.96	4.28 257.3	3.0 0.63
	7	9.7	+1.20	1.24 1.30	1 4 0	25.03	1.01	352.78	4.82 260.7	3.4 0.72
	8	10.7	-0.07	1.30 1.27	1 4 0	37.18	1.00	357.96	5.18 264.1	3.4 0.80
	9	11.7	-1.28	1.27 1.21	-1 +4 0	49.32	+0.98	3.27	5.31 267.4	3.3 0.87
	10	12.7	2.36	-1.28 -1.08	1 4 -1	61.46	0.96	8.48	+5.21 270.1	+2.7 0.93
	11	13.7	3.28	1.08 0.92	1 4 1	73.60	0.94	13.34	4.86 271.0	+0.9 0.97
	12	14.7	4.04	0.92 0.76	1 4 1	85.74	0.91	17.60	4.26 264.5	.. 0.99
	13	15.7	4.61	0.76 0.57	1 4 1	97.87	0.89	21.03	3.43 147.3	.. 1.00
	14	16.7	-4.99	0.57 0.38	-1 +4 -1	110.01	+0.85	23.47	2.44 117.2	.. 0.98
	15	17.7	-5.17	-0.38 -0.18	-1 +4 -1	122.14	+0.82	24.77	+1.30 113.7	-3.5 0.95

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic				Physical Libration	The Sun's Selenographic		Position Angle of		Frac- tion Illum.
		Long.	Lat.		Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb		
	d	°	°	°	(0°01)	°	°	°	°	°	
Feb.	15	17.7	-5.17	+0.37	-1 +4 -1	122.14	+0.82	24.77	113.7	0.95	
	16	18.7	5.16	-1.19	1 4 1	134.29	0.79	24.84	112.1	0.89	
	17	19.7	4.94	2.71	1 4 1	146.43	0.75	23.61	110.5	0.81	
	18	20.7	4.51	4.09	1 4 1	158.58	0.72	21.08	108.3	0.72	
	19	21.7	3.86	5.25	1 4 -1	170.74	0.68	17.30	105.4	0.61	
	20	22.7	-3.00	-6.12	-1 +4 0	182.91	+0.65	12.41	101.7	0.50	
	21	23.7	1.95	6.63	1 4 0	195.08	0.61	6.63	97.5	0.39	
	22	24.7	-0.75	6.72	1 4 0	207.26	0.58	0.33	93.0	0.28	
	23	25.7	+0.53	6.39	1 4 0	219.45	0.55	353.97	88.6	0.18	
	24	26.7	1.83	5.66	1 4 0	231.64	0.52	348.01	84.7	0.10	
	25	27.7	+3.03	-4.57	-1 +4 0	243.84	+0.49	342.91	82.3	0.04	
	26	28.7	4.04	3.20	1 4 0	256.04	0.46	338.97	84.2	0.01	
	27	0.2	4.80	1.66	1 4 0	268.24	0.44	336.36	224.5	0.00	
	28	1.2	5.24	-0.06	1 4 0	280.44	0.42	335.14	246.5	0.02	
	29	2.2	5.34	+1.52	1 4 +1	292.65	0.39	335.25	248.9	0.06	
	Mar.	1	3.2	+5.10	+2.97	-1 +4 0	304.85	+0.37	336.59	250.7	0.12
		2	4.2	4.54	4.25	1 4 0	317.04	0.36	339.01	252.8	0.19
		3	5.2	3.70	5.30	1 4 0	329.24	0.34	342.36	255.4	0.27
		4	6.2	2.66	6.09	1 4 0	341.42	0.32	346.47	258.5	0.36
		5	7.2	1.47	6.61	1 4 0	353.60	0.30	351.17	262.0	0.46
6		8.2	+0.21	+6.84	-1 +4 0	5.78	+0.29	356.26	265.8	0.55	
7		9.2	-1.05	6.78	2 4 0	17.95	0.27	1.54	269.8	0.64	
8		10.2	2.23	6.43	2 4 0	30.12	0.25	6.78	273.7	0.73	
9		11.2	3.28	5.80	2 4 0	42.28	0.22	11.76	277.4	0.81	
10		12.2	4.14	4.88	2 4 -1	54.43	0.20	16.23	280.7	0.88	
	11	13.2	-4.75	+3.72	-2 +4 -1	66.59	+0.17	19.97	283.4	0.94	
	12	14.2	5.11	2.35	2 4 1	78.74	0.14	22.78	285.3	0.98	
	13	15.2	5.19	+0.83	2 4 1	90.89	0.11	24.49	285.0	1.00	
	14	16.2	4.99	-0.77	2 4 1	103.03	0.07	24.95	109.0	1.00	
	15	17.2	4.53	2.35	2 4 -1	115.18	+0.04	24.08	107.8	0.97	
	16	18.2	-3.85	-3.82	-2 +4 0	127.34	0.00	21.84	106.1	0.92	
	17	19.2	2.98	5.07	2 4 0	139.49	-0.04	18.29	103.5	0.84	
	18	20.2	1.98	6.02	2 4 0	151.66	0.07	13.57	100.1	0.75	
	19	21.2	-0.91	6.61	2 4 0	163.83	0.11	7.94	96.0	0.64	
	20	22.2	+0.18	6.78	2 4 0	176.00	0.14	1.76	91.5	0.53	
	21	23.2	+1.25	-6.54	-2 +4 0	188.19	-0.18	355.46	86.7	0.42	
	22	24.2	2.23	5.90	1 4 0	200.38	0.21	349.49	82.2	0.31	
	23	25.2	3.09	4.91	1 4 0	212.58	0.24	344.26	78.1	0.21	
	24	26.2	3.79	3.64	1 4 0	224.79	0.27	340.06	74.6	0.13	
	25	27.2	4.31	2.17	1 4 +1	236.99	0.31	337.09	71.7	0.06	
	26	28.2	+4.62	-0.60	-1 +4 +1	249.21	-0.33	335.42	68.7	0.02	
	27	29.2	4.69	+0.98	1 4 1	261.43	0.36	335.07	56.1	0.00	
	28	0.7	4.53	2.48	1 4 1	273.64	0.39	335.97	260.2	0.00	
	29	1.7	4.11	3.83	1 4 +1	285.86	0.41	338.01	257.3	0.03	
	30	2.7	3.47	4.97	1 4 0	298.08	0.43	341.07	258.3	0.07	
Apr.	31	3.7	+2.61	+5.85	-1 +4 0	310.29	-0.45	344.97	260.6	0.13	
	1	4.7	+1.57	+6.46	-1 +4 0	322.50	-0.47	349.52	263.6	0.21	

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Frac- tion Illum.	
		Long.	Lat.	Lg. Lt. P. A.	Colong.	Lat.	Axis	Bright Limb		
	d	°	°	(0°01)	°	°	°	°		
Apr.	1	4.7	+1.57	+6.46	-1 +4 0	322.50	-0.47	349.52	263.6	0.21
	2	5.7	+0.39	6.78	2 4 0	334.71	0.49	354.53	267.1	0.29
	3	6.7	-0.86	6.81	2 4 0	346.91	0.50	359.78	270.9	0.38
	4	7.7	2.12	6.55	2 4 0	359.11	0.52	5.04	274.9	0.47
	5	8.7	3.33	6.00	2 4 0	11.30	0.54	10.09	278.7	0.57
	6	9.7	-4.40	+5.19	-2 +4 0	23.48	-0.56	14.71	282.3	0.66
	7	10.7	5.26	4.12	2 4 0	35.67	0.58	18.69	285.6	0.75
	8	11.7	5.84	2.84	2 4 -1	47.84	0.60	21.84	288.5	0.83
	9	12.7	6.09	+1.38	2 4 1	60.01	0.62	23.97	291.0	0.90
	10	13.7	5.97	-0.19	2 4 -1	72.18	0.65	24.93	293.8	0.96
	11	14.7	-5.47	-1.79	-2 +4 0	84.34	-0.68	24.56	300.1	0.99
	12	15.7	4.62	3.32	2 4 0	96.51	0.71	22.79	58.5	1.00
	13	16.7	3.46	4.67	2 4 0	108.67	0.74	19.60	95.5	0.98
	14	17.7	2.09	5.73	2 4 0	120.84	0.77	15.10	96.3	0.94
	15	18.7	-0.62	6.43	2 4 0	133.01	0.80	9.54	93.7	0.87
	16	19.7	+0.84	-6.70	-1 +4 0	145.18	-0.83	3.31	89.8	0.78
	17	20.7	2.17	6.54	1 4 0	157.36	0.86	356.88	85.4	0.67
	18	21.7	3.30	5.97	1 4 0	169.55	0.88	350.74	80.9	0.56
	19	22.7	4.19	5.05	1 4 +1	181.75	0.91	345.32	76.8	0.45
	20	23.7	4.81	3.85	1 4 1	193.96	0.94	340.91	73.2	0.34
	21	24.7	+5.17	-2.45	-1 +4 +1	206.17	-0.97	337.69	70.3	0.24
	22	25.7	5.28	-0.93	1 4 1	218.39	0.99	335.73	68.0	0.15
	23	26.7	5.17	+0.60	1 4 1	230.61	1.02	335.04	66.0	0.09
	24	27.7	4.87	2.09	1 4 1	242.84	1.04	335.58	63.2	0.04
	25	28.7	4.37	3.44	1 4 1	255.07	1.06	337.28	54.8	0.01
	26	0.1	+3.71	+4.61	-1 +4 +1	267.30	-1.08	340.01	324.0	0.00
	27	1.1	2.89	5.54	1 4 +1	279.54	1.10	343.65	272.9	0.01
	28	2.1	1.92	6.22	1 4 0	291.77	1.12	348.03	269.3	0.04
	29	3.1	+0.81	6.61	1 4 0	304.00	1.13	352.93	270.4	0.09
	30	4.1	-0.39	6.70	1 4 0	316.23	1.14	358.14	273.0	0.15
May	1	5.1	-1.67	+6.51	-1 +4 0	328.46	-1.15	3.42	276.3	0.23
	2	6.1	2.96	6.04	1 4 0	340.67	1.16	8.54	279.8	0.31
	3	7.1	4.21	5.31	1 4 0	352.89	1.17	13.27	283.1	0.40
	4	8.1	5.33	4.33	1 4 0	5.10	1.18	17.43	286.3	0.50
	5	9.1	6.24	3.15	1 4 0	17.30	1.20	20.82	289.0	0.59
	6	10.1	-6.87	+1.78	-1 +4 0	29.50	-1.21	23.30	291.3	0.69
	7	11.1	7.14	+0.29	1 4 0	41.69	1.22	24.70	293.0	0.78
	8	12.1	6.98	-1.25	1 4 0	53.88	1.23	24.87	294.4	0.86
	9	13.1	6.35	2.78	1 4 0	66.06	1.25	23.69	296.0	0.93
	10	14.1	5.26	4.18	1 4 0	78.24	1.27	21.08	300.3	0.98
	11	15.1	-3.77	-5.33	-1 +4 0	90.42	-1.28	17.04	337.3	1.00
	12	16.1	2.00	6.14	1 4 0	102.59	1.30	11.75	77.5	0.99
	13	17.1	-0.10	6.54	1 4 0	114.77	1.31	5.53	84.6	0.95
	14	18.1	+1.77	6.48	1 4 0	126.96	1.33	358.90	83.0	0.89
	15	19.1	3.43	5.98	1 4 +1	139.14	1.35	352.42	79.5	0.80
	16	20.1	+4.78	-5.11	-1 +4 +1	151.34	-1.36	346.61	75.8	0.70
	17	21.1	+5.76	-3.93	-1 +4 +1	163.54	-1.38	341.84	72.5	0.59

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illum.
		Long.	Lat.	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
	d	°	°	(0°01)	°	°	°	°	
May 17	21.1	+5.76	-3.93	-1 +4 +1	163.54	-1.38	341.84	72.5	0.59
18	22.1	6.34	2.55	1 4 1	175.75	1.40	338.29	69.8	0.48
19	23.1	6.55	-1.06	1 4 1	187.96	1.41	336.05	67.8	0.37
20	24.1	6.45	+0.45	1 4 1	200.19	1.43	335.09	66.5	0.27
21	25.1	6.07	1.91	1 4 1	212.41	1.44	335.36	65.7	0.19
22	26.1	+5.48	+3.25	-1 +4 +1	224.65	-1.46	336.78	65.2	0.12
23	27.1	4.72	4.41	1 4 1	236.89	1.47	339.24	64.2	0.06
24	28.1	3.82	5.35	1 4 1	249.13	1.48	342.63	60.4	0.02
25	29.1	2.81	6.05	1 4 1	261.37	1.49	346.79	38.9	0.00
26	0.5	1.70	6.46	1 4 +1	273.62	1.50	351.56	304.4	0.00
27	1.5	+0.51	+6.59	-1 +4 0	285.86	-1.51	356.71	283.3	0.02
28	2.5	-0.76	6.43	1 4 0	298.11	1.51	1.99	281.0	0.06
29	3.5	2.06	6.00	1 4 0	310.35	1.52	7.17	282.3	0.11
30	4.5	3.37	5.31	1 4 0	322.59	1.52	12.02	284.6	0.17
31	5.5	4.63	4.38	1 4 0	334.82	1.51	16.32	287.1	0.25
June 1	6.5	-5.79	+3.26	-1 +4 0	347.05	-1.51	19.91	289.4	0.34
2	7.5	6.75	1.97	1 4 0	359.28	1.51	22.63	291.4	0.43
3	8.5	7.45	+0.55	1 4 0	11.49	1.51	24.36	292.8	0.53
4	9.5	7.78	-0.93	1 4 0	23.70	1.51	24.96	293.6	0.64
5	10.5	7.68	2.40	1 4 0	35.91	1.51	24.32	293.9	0.74
6	11.5	-7.08	-3.79	-1 +4 0	48.11	-1.51	22.33	293.6	0.83
7	12.5	5.97	4.99	1 4 0	60.30	1.51	18.94	293.3	0.91
8	13.5	4.39	5.89	1 4 0	72.49	1.51	14.19	294.7	0.96
9	14.5	2.44	6.41	-1 4 0	84.67	1.51	8.30	310.2	0.99
10	15.5	-0.30	6.47	0 4 0	96.86	1.51	1.67	54.7	0.99
11	16.5	+1.83	-6.08	0 +4 +1	109.05	-1.51	354.89	73.4	0.97
12	17.5	3.77	5.26	0 4 1	121.24	1.51	348.59	73.7	0.91
13	18.5	5.37	4.10	0 4 1	133.43	1.51	343.24	71.7	0.83
14	19.5	6.52	2.70	0 4 1	145.63	1.51	339.18	69.5	0.73
15	20.5	7.21	-1.18	0 4 1	157.84	1.51	336.51	67.8	0.63
16	21.5	+7.45	+0.36	0 +4 +1	170.05	-1.51	335.21	66.7	0.52
17	22.5	7.30	1.83	0 4 1	182.27	1.52	335.21	66.4	0.42
18	23.5	6.83	3.19	0 4 1	194.50	1.52	336.38	66.8	0.32
19	24.5	6.10	4.36	0 4 1	206.74	1.52	338.62	67.6	0.23
20	25.5	5.18	5.31	0 4 1	218.97	1.52	341.80	68.8	0.15
21	26.5	+4.13	+6.01	0 +4 +1	231.22	-1.53	345.77	69.8	0.09
22	27.5	2.98	6.44	0 4 1	243.47	1.53	350.38	69.6	0.04
23	28.5	1.76	6.58	0 4 +1	255.71	1.53	355.43	63.9	0.01
24	29.5	+0.49	6.44	0 4 0	267.97	1.52	0.69	18.2	0.00
25	0.9	-0.80	6.02	0 4 0	280.22	1.52	5.93	301.2	0.01
26	1.9	-2.10	+5.34	0 +4 0	292.47	-1.51	10.89	290.8	0.03
27	2.9	3.38	4.43	0 4 0	304.72	1.50	15.35	289.7	0.07
28	3.9	4.61	3.32	0 4 0	316.96	1.49	19.11	290.5	0.13
29	4.9	5.72	2.05	0 4 0	329.20	1.48	22.04	291.7	0.20
30	5.9	6.66	+0.66	0 4 0	341.44	1.47	24.01	292.7	0.29
July 1	6.9	-7.35	-0.78	0 +4 0	353.67	-1.45	24.91	293.2	0.38
2	7.9	-7.72	-2.23	0 +4 0	5.90	-1.44	24.65	293.1	0.48

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^b UNIVERSAL TIME

Date	Age	The Earth's Selenographic				Physical Libration		The Sun's Selenographic		Position Angle of				Fraction Illum.
		Long.		Lat.		Lg. Lt. P. A.		Colong.	Lat.	Axis		Bright Limb		
July	d	°	°	°	°	(0°01)		°	°	°	°	°	°	
	1	6.9	-7.35	-0.37	-0.78	-1.45	0 +4 0	353.67	-1.45	24.91	-0.26	293.2	0	0.38
	2	7.9	7.72	+0.03	2.23	1.36	0 4 0	5.90	1.44	24.65	1.50	293.1	-0.1	0.48
	3	8.9	7.69	0.50	3.59	1.21	0 4 0	18.11	1.42	23.15	2.80	292.4	0.7	0.59
	4	9.9	7.19	0.99	4.80	0.95	0 4 0	30.32	1.41	20.35	4.12	290.9	1.5	0.70
	5	10.9	6.20	1.47	5.75	0.61	0 4 0	42.53	1.39	16.23	5.32	288.7	2.2	0.80
	6	11.9	-4.73	+1.85	-6.36	-0.20	0 +4 0	54.73	-1.38	10.91	-6.28	286.3	2.4	0.88
	7	12.9	2.88	2.10	6.56	+0.26	0 4 0	66.92	1.36	4.63	6.75	284.9	-1.4	0.95
	8	13.9	-0.78	2.15	6.30	0.72	0 4 +1	79.11	1.34	357.88	6.64	290.5	·	0.99
	9	14.9	+1.37	2.03	5.58	1.10	0 4 1	91.30	1.33	351.24	5.91	23.4	·	1.00
	10	15.9	3.40	1.71	4.48	1.40	0 4 1	103.49	1.31	345.33	4.73	65.2	+2.8	0.98
	11	16.9	+5.11	+1.30	-3.08	+1.58	+1 +4 +1	115.68	-1.30	340.60	-3.30	68.0	-0.4	0.93
	12	17.9	6.41	0.83	-1.50	1.61	1 4 1	127.88	1.28	337.30	1.81	67.6	0.5	0.86
	13	18.9	7.24	0.36	+0.11	1.66	1 4 1	140.07	1.27	335.49	-0.40	67.1	-0.1	0.77
	14	19.9	7.60	+0.36	1.67	1.43	1 4 1	152.28	1.25	335.09	+0.87	67.0	+0.6	0.67
15	20.9	7.53	-0.07	3.10	1.23	1 4 1	164.49	1.24	335.96	2.01	67.6	1.3	0.57	
	16	21.9	+7.09	-0.74	+4.33	+1.00	+1 +4 +1	176.71	-1.23	337.97	+2.99	68.9	+1.9	0.46
	17	22.9	6.35	0.96	5.33	0.73	1 4 1	188.94	1.22	340.96	3.81	70.8	2.3	0.37
	18	23.9	5.39	1.12	6.06	0.46	1 4 1	201.17	1.22	344.77	4.47	73.1	2.6	0.28
	19	24.9	4.27	1.22	6.52	+0.16	1 4 1	213.41	1.21	349.24	4.95	75.7	2.7	0.19
	20	25.9	3.05	1.27	6.68	-0.11	1 4 1	225.65	1.20	354.19	5.23	78.4	2.2	0.13
	21	26.9	+1.78	-1.30	+6.57	-0.40	+1 +4 +1	237.89	-1.19	359.42	+5.26	80.6	+0.4	0.07
	22	27.9	+0.48	1.29	6.17	0.67	1 4 +1	250.14	1.18	4.68	5.05	81.0	·	0.03
	23	28.9	-0.81	1.24	5.50	0.91	1 4 0	262.39	1.16	9.73	4.61	72.7	·	0.01
	24	0.2	2.05	1.19	4.59	1.11	1 4 0	274.64	1.15	14.34	3.97	337.4	·	0.00
	25	1.2	3.24	1.09	3.48	1.29	1 4 0	286.89	1.13	18.31	3.15	297.7	-4.1	0.01
	26	2.2	-4.33	-0.97	+2.19	-1.39	+1 +4 0	299.14	-1.11	21.46	+2.20	293.6	-0.7	0.05
	27	3.2	5.30	0.79	+0.80	1.46	1 4 0	311.39	1.09	23.66	1.14	292.9	0.2	0.10
	28	4.2	6.09	0.57	-0.66	1.45	1 4 0	323.63	1.07	24.80	+0.01	292.7	0.4	0.16
	29	5.2	6.66	-0.28	2.11	1.37	1 4 0	335.87	1.05	24.81	-1.17	292.3	0.9	0.24
	30	6.2	6.94	+0.05	3.48	1.23	1 4 0	348.10	1.02	23.64	2.40	291.4	1.7	0.34
Aug.	31	7.2	-6.89	+0.45	-4.71	-0.99	+1 +4 0	0.32	-1.00	21.24	-3.62	289.7	-2.4	0.44
	1	8.2	6.44	0.85	5.70	0.68	1 4 0	12.54	0.97	17.62	4.79	287.3	3.3	0.55
	2	9.2	5.59	1.24	6.38	-0.30	1 4 0	24.75	0.94	12.83	5.78	284.0	3.8	0.66
	3	10.2	4.35	1.58	6.68	+0.12	1 4 +1	36.95	0.92	7.05	6.44	280.2	4.0	0.77
	4	11.2	2.77	1.82	6.56	0.58	1 4 1	49.15	0.89	0.61	6.61	276.2	3.5	0.86
	5	12.2	-0.95	+1.90	-5.98	+0.99	+1 +3 +1	61.34	-0.86	354.00	-6.21	272.7	-0.4	0.93
	6	13.2	+0.95	1.84	4.99	1.33	1 3 1	73.53	0.83	347.79	5.28	272.3	·	0.98
	7	14.2	2.79	1.62	3.66	1.57	1 3 1	85.71	0.80	342.51	3.97	314.8	·	1.00
	8	15.2	4.41	1.29	2.09	1.68	1 4 1	97.90	0.77	338.54	2.48	62.6	·	0.99
	9	16.2	5.70	0.89	-0.41	1.66	2 4 1	110.08	0.74	336.06	-0.97	66.9	+0.9	0.95
	10	17.2	+6.59	+0.45	+1.25	+1.55	+2 +4 +2	122.27	-0.72	335.09	+0.43	67.8	+0.8	0.89
	11	18.2	7.04	+0.03	2.80	1.34	2 4 2	134.47	0.69	335.52	1.69	68.6	1.4	0.81
	12	19.2	7.07	-0.35	4.14	1.10	2 4 2	146.66	0.67	337.21	2.75	70.0	2.0	0.72
	13	20.2	6.72	0.67	5.24	0.81	2 4 2	158.87	0.65	339.96	3.65	72.0	2.5	0.62
	14	21.2	6.05	0.93	6.05	0.53	2 4 1	171.08	0.63	343.61	4.35	74.5	3.1	0.52
15	22.2	+5.12	-1.12	+6.58	+0.22	+2 +4 +1	183.30	-0.61	347.96	+4.87	77.6	+3.5	0.43	
16	23.2	+4.00		+6.80		+2 +4 +1	195.52	-0.60	352.83		81.1		0.33	

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illum.
		Long.	Lat.	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
	d	°	°	(0°01)	°	°	°	°	
Aug. 16	23.2	+4.00	+6.80	+2 +4 +1	195.52	-0.60	352.83	81.1	0.33
17	24.2	2.77	6.74	2 4 1	207.74	0.58	358.01	84.7	0.25
18	25.2	1.48	6.38	2 4 1	219.97	0.57	3.28	88.4	0.17
19	26.2	+0.19	5.75	2 4 1	232.21	0.55	8.41	91.9	0.10
20	27.2	-1.06	4.87	2 4 +1	244.45	0.53	13.17	94.7	0.05
21	28.2	-2.22	+3.77	+1 +4 0	256.69	-0.51	17.34	95.8	0.02
22	29.2	3.25	2.49	1 4 0	268.93	0.49	20.74	86.0	0.00
23	0.6	4.14	+1.08	1 4 0	281.18	0.47	23.21	298.1	0.00
24	1.6	4.86	-0.40	1 4 0	293.42	0.44	24.63	292.0	0.03
25	2.6	5.37	1.89	1 4 0	305.66	0.42	24.91	290.8	0.07
26	3.6	-5.65	-3.31	+1 +4 0	317.89	-0.39	23.99	289.8	0.13
27	4.6	5.69	4.57	1 3 0	330.12	0.36	21.87	288.2	0.21
28	5.6	5.45	5.61	1 3 0	342.35	0.33	18.55	285.8	0.30
29	6.6	4.93	6.36	1 3 0	354.57	0.30	14.10	282.6	0.41
30	7.6	4.13	6.74	2 3 +1	6.77	0.27	8.69	278.7	0.52
31	8.6	-3.08	-6.72	+2 +3 +1	18.98	-0.24	2.59	274.3	0.64
Sept. 1	9.6	1.80	6.28	2 3 1	31.17	0.20	356.20	269.5	0.74
2	10.6	-0.38	5.43	2 3 1	43.36	0.16	349.98	264.8	0.84
3	11.6	+1.10	4.22	2 3 1	55.55	0.13	344.45	260.6	0.92
4	12.6	2.54	2.74	2 3 1	67.72	0.09	340.00	257.3	0.97
5	13.6	+3.83	-1.08	+2 +3 +1	79.90	-0.05	336.92	256.2	1.00
6	14.6	4.90	+0.62	2 3 2	92.07	-0.02	335.33	70.5	1.00
7	15.6	5.66	2.25	2 4 2	104.25	+0.01	335.19	71.3	0.97
8	16.6	6.08	3.71	2 4 2	116.42	0.04	336.42	72.1	0.92
9	17.6	6.14	4.93	2 4 2	128.60	0.07	338.83	73.7	0.85
10	18.6	+5.85	+5.87	+2 +4 +2	140.79	+0.10	342.25	76.0	0.77
11	19.6	5.23	6.50	2 4 1	152.98	0.12	346.46	78.9	0.68
12	20.6	4.35	6.81	2 4 1	165.17	0.14	351.25	82.4	0.59
13	21.6	3.26	6.83	2 4 1	177.37	0.16	356.40	86.2	0.49
14	22.6	2.04	6.55	2 4 1	189.58	0.18	1.69	90.2	0.40
15	23.6	+0.75	+5.98	+2 +4 +1	201.79	+0.20	6.89	94.2	0.31
16	24.6	-0.53	5.17	2 4 1	214.01	0.22	11.77	98.1	0.22
17	25.6	1.74	4.13	2 4 +1	226.23	0.23	16.14	101.8	0.15
18	26.6	2.82	2.89	2 4 0	238.45	0.25	19.79	105.1	0.09
19	27.6	3.70	1.50	2 4 0	250.68	0.27	22.57	108.4	0.04
20	28.6	-4.36	+0.01	+2 +4 0	262.91	+0.29	24.32	112.8	0.01
21	0.0	4.77	-1.50	2 3 0	275.14	0.31	24.94	221.8	0.00
22	1.0	4.91	2.97	2 3 0	287.37	0.34	24.35	282.7	0.01
23	2.0	4.79	4.29	2 3 0	299.59	0.36	22.50	284.1	0.05
24	3.0	4.41	5.40	2 3 +1	311.82	0.39	19.41	283.0	0.10
25	4.0	-3.82	-6.22	+2 +3 +1	324.03	+0.42	15.17	280.6	0.18
26	5.0	3.04	6.67	2 3 1	336.25	0.45	9.94	277.1	0.27
27	6.0	2.13	6.74	2 3 1	348.45	0.48	4.00	272.9	0.38
28	7.0	1.12	6.39	2 3 1	0.65	0.51	357.73	268.2	0.49
29	8.0	-0.06	5.65	2 3 1	12.84	0.54	351.57	263.4	0.61
30	9.0	+1.01	-4.56	+2 +3 +1	25.02	+0.58	345.96	258.8	0.72
Oct. 1	10.0	+2.05	-3.19	+2 +3 +1	37.20	+0.61	341.28	254.7	0.81

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic				Physical Libration			The Sun's Selenographic		Position Angle of				Frac- tion Illum.
		Long.		Lat.		Lg. Lt. P. A.			Colong.	Lat.	Axis		Bright Limb		
		°	′	°	′	(0°01)			°	′	°	′	°	′	
Oct.	1	10.0	+2.05	-3.19	+2 +3 +1			37.20	+0.61	341.28	254.7	0.81			
	2	11.0	3.01	-1.62	2 3 2			49.37	0.65	337.83	251.0	0.90			
	3	12.0	3.85	+0.03	2 3 2			61.54	0.69	335.75	247.3	0.95			
	4	13.0	4.53	1.66	2 3 2			73.70	0.72	335.08	240.7	0.99			
	5	14.0	4.99	3.17	2 3 2			85.85	0.75	335.80	136.5	1.00			
	6	15.0	+5.21	+4.47	+2 +3 +2			98.01	+0.79	337.78	83.0	0.99			
	7	16.0	5.16	5.51	2 4 2			110.17	0.81	340.86	80.5	0.95			
	8	17.0	4.82	6.25	2 4 2			122.34	0.84	344.84	81.7	0.90			
	9	18.0	4.20	6.67	2 4 1			134.51	0.86	349.51	84.2	0.83			
	10	19.0	3.33	6.77	2 4 1			146.67	0.88	354.62	87.5	0.75			
	11	20.0	+2.24	+6.57	+2 +4 +1			158.85	+0.90	359.94	91.2	0.66			
	12	21.0	+1.01	6.09	2 4 1			171.03	0.91	5.21	95.1	0.57			
	13	22.0	-0.30	5.35	2 4 1			183.22	0.92	10.21	99.0	0.47			
	14	23.0	1.60	4.39	2 4 1			195.41	0.94	14.75	102.7	0.38			
	15	24.0	2.82	3.22	2 4 1			207.60	0.95	18.64	106.1	0.29			
	16	25.0	-3.86	+1.89	+2 +3 +1			219.81	+0.96	21.71	109.1	0.21			
	17	26.0	4.66	+0.46	2 3 1			232.01	0.97	23.82	111.9	0.13			
	18	27.0	5.15	-1.03	2 3 1			244.22	0.99	24.85	114.7	0.07			
	19	28.0	5.30	2.51	2 3 1			256.43	1.00	24.68	118.9	0.03			
	20	29.0	5.08	3.88	2 3 1			268.64	1.02	23.24	137.1	0.00			
	21	0.5	-4.51	-5.05	+2 +3 +1			280.86	+1.03	20.50	258.3	0.00			
	22	1.5	3.66	5.95	2 3 1			293.07	1.05	16.50	273.0	0.03			
	23	2.5	2.58	6.49	2 3 1			305.28	1.07	11.40	273.3	0.08			
	24	3.5	1.39	6.63	2 3 1			317.48	1.09	5.48	270.6	0.15			
	25	4.5	-0.17	6.35	2 3 1			329.68	1.11	359.15	266.7	0.25			
	26	5.5	+0.99	-5.68	+2 +3 +1			341.87	+1.13	352.87	262.3	0.35			
	27	6.5	2.04	4.65	2 3 2			354.06	1.16	347.12	258.0	0.46			
	28	7.5	2.93	3.36	2 3 2			6.24	1.19	342.26	254.0	0.58			
	29	8.5	3.65	1.87	2 3 2			18.41	1.21	338.56	250.6	0.69			
	30	9.5	4.22	-0.29	2 3 2			30.57	1.24	336.18	247.9	0.78			
	31	10.5	+4.62	+1.29	+2 +3 +2			42.72	+1.27	335.14	245.6	0.87			
	1	11.5	4.87	2.78	2 3 2			54.87	1.29	335.44	243.2	0.93			
	2	12.5	4.95	4.09	2 3 2			67.02	1.32	337.00	238.8	0.97			
	3	13.5	4.85	5.17	2 3 2			79.17	1.34	339.70	217.3	1.00			
	4	14.5	4.55	5.97	2 3 2			91.31	1.36	343.37	111.4	1.00			
	5	15.5	+4.04	+6.46	+2 +3 +2			103.46	+1.38	347.83	93.3	0.97			
	6	16.5	3.31	6.63	2 3 1			115.60	1.40	352.84	91.9	0.94			
	7	17.5	2.37	6.50	2 3 1			127.75	1.41	358.15	93.7	0.88			
	8	18.5	+1.24	6.08	2 3 1			139.90	1.42	3.49	96.6	0.81			
	9	19.5	-0.03	5.40	2 3 1			152.06	1.42	8.63	99.9	0.73			
10	20.5	-1.37	+4.49	+2 +3 +1			164.22	+1.43	13.33	103.2	0.65				
11	21.5	2.72	3.39	2 3 1			176.38	1.43	17.42	106.4	0.55				
12	22.5	3.98	2.14	2 3 1			188.55	1.43	20.74	109.1	0.46				
13	23.5	5.07	+0.77	2 3 1			200.73	1.43	23.17	111.5	0.36				
14	24.5	5.88	-0.66	1 3 1			212.91	1.43	24.59	113.3	0.27				
15	25.5	-6.33	-2.10	+1 +3 +1			225.10	+1.43	24.89	114.7	0.19				
16	26.5	-6.36	-3.47	+1 +3 +1			237.29	+1.43	23.97	116.0	0.11				

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic			Physical Libration			The Sun's Selenographic		Position Angle of				Frac- tion Illum.	
		Long.		Lat.	Lg. Lt. P. A.			Colong.	Lat.	Axis		Bright Limb			
	d	°	'	°	(0°01)			°	°	°	'	°	'		
Nov. 16	26.5	-6.36	+0.43	-3.47	+1	+3	+1	237.29	+1.43	23.97	-2.22	116.0	+1.9	0.11	
17	27.5	5.93	0.88	4.68	1	3	1	249.49	1.44	21.75	3.54	117.9	0.05		
18	28.5	5.05	1.26	5.65	1	3	1	261.69	1.44	18.21	4.78	125.2	+7.3	0.01	
19	0.0	3.79	1.54	6.29	1	3	1	273.89	1.44	13.43	5.81	194.5	0.00		
20	1.0	2.25	1.67	6.52	-0.23	1	3	1	286.09	1.45	7.62	6.44	258.0	0.02	
					+0.20										
21	2.0	-0.58	+1.64	-6.32	+1	+3	+1	298.28	+1.45	1.18	-6.55	262.3	-1.9	0.06	
22	3.0	+1.06	1.49	5.70	+0.62	1	3	2	310.48	1.46	354.63	6.12	260.4	3.4	0.13
23	4.0	2.55	1.24	4.70	1.28	1	3	2	322.66	1.47	348.51	5.22	257.0	3.5	0.21
24	5.0	3.79	0.95	3.42	1.48	2	3	2	334.84	1.48	343.29	4.03	253.5	3.0	0.32
25	6.0	4.74	0.65	1.94	1.57	2	3	2	347.02	1.49	339.26	2.68	250.5	2.4	0.43
26	7.0	+5.39	+0.36	-0.37	+1.55	+2	+3	+2	359.18	+1.50	336.58	-1.32	248.1	-1.6	0.54
27	8.0	5.75	+0.12	+1.18	1.47	2	3	2	11.34	1.52	335.26	+0.01	246.5	1.0	0.65
28	9.0	5.87	-0.08	2.65	1.30	2	3	2	23.50	1.53	335.27	1.25	245.5	0.4	0.74
29	10.0	5.79	0.27	3.95	1.07	2	3	2	35.64	1.54	336.52	2.37	245.1	0.3	0.83
30	11.0	5.52	0.44	5.02	0.81	2	3	2	47.78	1.55	338.89	3.37	244.8	1.3	0.90
Dec. 1	12.0	+5.08	-0.59	+5.83	+0.51	+2	+3	+2	59.92	+1.57	342.26	+4.20	243.5	-6.1	0.95
2	13.0	4.49	0.75	6.34	+0.21	2	3	2	72.06	1.57	346.46	4.84	237.4	0.98	
3	14.0	3.74	0.91	6.55	-0.09	2	3	2	84.19	1.58	351.30	5.23	194.0	1.00	
4	15.0	2.83	1.07	6.46	0.39	2	3	2	96.32	1.58	356.53	5.36	114.3	0.99	
5	16.0	1.76	1.20	6.07	0.65	2	3	1	108.45	1.58	1.89	5.24	103.6	-0.6	0.97
6	17.0	+0.56	-1.32	+5.42	-0.88	+1	+3	+1	120.59	+1.58	7.13	+4.86	103.0	+1.7	0.93
7	18.0	-0.76	1.39	4.54	1.07	1	3	1	132.72	1.57	11.99	4.28	104.7	2.2	0.87
8	19.0	2.15	1.39	3.47	1.23	1	3	1	144.87	1.56	16.27	3.55	106.9	2.3	0.80
9	20.0	3.54	1.31	2.24	1.33	1	3	1	157.01	1.55	19.82	2.68	109.2	2.0	0.72
10	21.0	4.85	1.14	+0.91	1.39	1	3	1	169.16	1.54	22.50	1.73	111.2	1.5	0.63
11	22.0	-5.99	-0.88	-0.48	-1.39	+1	+3	+1	181.32	+1.53	24.23	+0.68	112.7	+0.9	0.54
12	23.0	6.87	0.52	1.87	1.34	1	3	1	193.48	1.51	24.91	-0.45	113.6	+0.3	0.44
13	24.0	7.39	-0.07	3.21	1.22	1	3	1	205.65	1.50	24.46	1.65	113.9	-0.2	0.34
14	25.0	7.46	+0.42	4.43	1.01	1	3	1	217.82	1.49	22.81	2.93	113.7	0.8	0.25
15	26.0	7.04	0.95	5.44	0.72	1	3	1	230.00	1.47	19.88	4.20	112.9	-0.7	0.16
16	27.0	-6.09	+1.42	-6.16	-0.35	+1	+3	+1	242.19	+1.46	15.68	-5.38	112.2	+1.3	0.09
17	28.0	4.67	1.78	6.51	+0.08	1	3	1	254.38	1.45	10.30	6.27	113.5	0.03	
18	29.0	2.89	2.00	6.43	0.53	1	3	1	266.57	1.44	4.03	6.72	132.1	0.00	
19	0.6	-0.89	2.01	5.90	0.95	1	3	2	278.76	1.43	357.31	6.55	237.9	0.01	
20	1.6	+1.12	1.87	4.95	1.29	1	3	2	290.95	1.42	350.76	5.79	252.4	0.0	0.04
21	2.6	+2.99	+1.57	-3.66	+1.52	+1	+3	+2	303.14	+1.41	344.97	-4.61	252.4	-2.0	0.10
22	3.6	4.56	1.20	2.14	1.63	1	3	2	315.32	1.41	340.36	3.18	250.4	1.9	0.18
23	4.6	5.76	0.80	-0.51	1.61	1	3	2	327.50	1.40	337.18	1.71	248.5	1.3	0.27
24	5.6	6.56	0.41	+1.10	1.51	1	3	2	339.67	1.40	335.47	-0.30	247.2	-0.6	0.38
25	6.6	6.97	+0.07	2.61	1.33	1	3	2	351.83	1.39	335.17	+0.98	246.6	+0.2	0.49
26	7.6	+7.04	-0.23	+3.94	+1.10	+1	+3	+2	3.99	+1.39	336.15	+2.14	246.8	+0.9	0.59
27	8.6	6.81	0.48	5.04	0.82	1	3	2	16.13	1.39	338.29	3.14	247.7	1.4	0.69
28	9.6	6.33	0.67	5.86	0.53	1	3	2	28.28	1.38	341.43	3.98	249.1	1.7	0.78
29	10.6	5.66	0.84	6.39	+0.23	1	3	2	40.42	1.38	345.41	4.65	250.8	1.5	0.86
30	11.6	4.82	0.98	6.62	-0.08	1	3	2	52.55	1.37	350.06	5.10	252.3	+0.2	0.92
31	12.6	+3.84	-1.10	+6.54	-0.37	+1	+3	+2	64.68	+1.37	355.16	+5.32	252.5	0.96	
32	13.6	+2.74		+6.17		+1	+3	+2	76.81	+1.35	0.48		246.1	0.99	

EPHEMERIS FOR PHYSICAL OBSERVATIONS

TABLE FOR OPTICAL LIBRATION OF THE MOON

$\lambda - \Omega$	μ	A	B	$\lambda - \Omega$	$\lambda - \Omega$	μ	A	B	$\lambda - \Omega$
°	°		°	°	°	°		°	°
0	0.000	+0.0268-	0.000	180	45	+0.010+	+0.0189-	-1.085+	225
1	.000	.0268	-0.027+	181	46	.010	.0186	1.104	226
2	+ .001+	.0268	0.054	182	47	.010	.0183	1.123	227
3	.001	.0268	0.080	183	48	.010	.0179	1.141	228
4	.001	.0267	0.107	184	49	.010	.0176	1.159	229
5	+0.002+	+0.0267-	-0.134+	185	50	+0.010+	+0.0172-	-1.176+	230
6	.002	.0266	0.160	186	51	.010	.0169	1.193	231
7	.002	.0266	0.187	187	52	.010	.0165	1.210	232
8	.003	.0265	0.214	188	53	.010	.0161	1.226	233
9	.003	.0265	0.240	189	54	.010	.0157	1.242	234
10	+0.004+	+0.0264-	-0.267+	190	55	+0.010+	+0.0154-	-1.258+	235
11	.004	.0263	0.293	191	56	.010	.0150	1.273	236
12	.004	.0262	0.319	192	57	.009	.0146	1.287	237
13	.005	.0261	0.345	193	58	.009	.0142	1.302	238
14	.005	.0260	0.371	194	59	.009	.0138	1.316	239
15	+0.005+	+0.0259-	-0.397+	195	60	+0.009+	+0.0134-	-1.329+	240
16	.005	.0257	0.423	196	61	.009	.0130	1.343	241
17	.006	.0256	0.449	197	62	.009	.0126	1.355	242
18	.006	.0255	0.474	198	63	.008	.0122	1.368	243
19	.006	.0253	0.500	199	64	.008	.0117	1.380	244
20	+0.007+	+0.0252-	-0.525+	200	65	+0.008+	+0.0113-	-1.391+	245
21	.007	.0250	0.550	201	66	.008	.0109	1.402	246
22	.007	.0248	0.575	202	67	.007	.0105	1.413	247
23	.007	.0247	0.600	203	68	.007	.0100	1.423	248
24	.008	.0245	0.624	204	69	.007	.0096	1.433	249
25	+0.008+	+0.0243-	-0.649+	205	70	+0.007+	+0.0092-	-1.442+	250
26	.008	.0241	0.673	206	71	.006	.0087	1.451	251
27	.008	.0239	0.697	207	72	.006	.0083	1.460	252
28	.009	.0237	0.721	208	73	.006	.0078	1.468	253
29	.009	.0234	0.744	209	74	.005	.0074	1.476	254
30	+0.009+	+0.0232-	-0.768+	210	75	+0.005+	+0.0069-	-1.483+	255
31	.009	.0230	0.791	211	76	.005	.0065	1.489	256
32	.009	.0227	0.814	212	77	.005	.0060	1.496	257
33	.009	.0225	0.836	213	78	.004	.0056	1.502	258
34	.010	.0222	0.859	214	79	.004	.0051	1.507	259
35	+0.010+	+0.0219-	-0.881+	215	80	+0.004+	+0.0047-	-1.512+	260
36	.010	.0217	0.902	216	81	.003	.0042	1.516	261
37	.010	.0214	0.924	217	82	.003	.0037	1.520	262
38	.010	.0211	0.945	218	83	.002	.0033	1.524	263
39	.010	.0208	0.966	219	84	.002	.0028	1.527	264
40	+0.010+	+0.0205-	-0.987+	220	85	+0.002+	+0.0023-	-1.529+	265
41	.010	.0202	1.007	221	86	.001	.0019	1.531	266
42	.010	.0199	1.027	222	87	.001	.0014	1.533	267
43	.010	.0196	1.047	223	88	+ .001+	.0009	1.534	268
44	.010	.0193	1.066	224	89	.000	+ .0005-	1.535	269
45	+0.010+	+0.0189-	-1.085+	225	90	0.000	0.0000	-1.535+	270

The sign is to be taken from the same side as the argument.

EPHEMERIS FOR PHYSICAL OBSERVATIONS

TABLE FOR OPTICAL LIBRATION OF THE MOON

$\lambda - \Omega$	μ	A	B	$\lambda - \Omega$	$\lambda - \Omega$	μ	A	B	$\lambda - \Omega$
°	°		°	°	°	°		°	°
90	0.000	0.0000	-1.535+	270	135	-0.010-	-0.0189+	-1.085+	315
91	.000	- .0005+	1.535	271	136	.010	.0193	1.066	316
92	- .001-	.0009	1.534	272	137	.010	.0196	1.047	317
93	.001	.0014	1.533	273	138	.010	.0199	1.027	318
94	.001	.0019	1.531	274	139	.010	.0202	1.007	319
95	-0.002-	-0.0023+	-1.529+	275	140	-0.010-	-0.0205+	-0.987+	320
96	.002	.0028	1.527	276	141	.010	.0208	0.966	321
97	.002	.0033	1.524	277	142	.010	.0211	0.945	322
98	.003	.0037	1.520	278	143	.010	.0214	0.924	323
99	.003	.0042	1.516	279	144	.010	.0217	0.902	324
100	-0.004-	-0.0047+	-1.512+	280	145	-0.010-	-0.0219+	-0.881+	325
101	.004	.0051	1.507	281	146	.010	.0222	0.859	326
102	.004	.0056	1.502	282	147	.009	.0225	0.836	327
103	.005	.0060	1.496	283	148	.009	.0227	0.814	328
104	.005	.0065	1.489	284	149	.009	.0230	0.791	329
105	-0.005-	-0.0069+	-1.483+	285	150	-0.009-	-0.0232+	-0.768+	330
106	.005	.0074	1.476	286	151	.009	.0234	0.744	331
107	.006	.0078	1.468	287	152	.009	.0237	0.721	332
108	.006	.0083	1.460	288	153	.008	.0239	0.697	333
109	.006	.0087	1.451	289	154	.008	.0241	0.673	334
110	-0.007-	-0.0092+	-1.442+	290	155	-0.008-	-0.0243+	-0.649+	335
111	.007	.0096	1.433	291	156	.008	.0245	0.624	336
112	.007	.0100	1.423	292	157	.007	.0247	0.600	337
113	.007	.0105	1.413	293	158	.007	.0248	0.575	338
114	.008	.0109	1.402	294	159	.007	.0250	0.550	339
115	-0.008-	-0.0113+	-1.391+	295	160	-0.007-	-0.0252+	-0.525+	340
116	.008	.0117	1.380	296	161	.006	.0253	0.500	341
117	.008	.0122	1.368	297	162	.006	.0255	0.474	342
118	.009	.0126	1.355	298	163	.006	.0256	0.449	343
119	.009	.0130	1.343	299	164	.005	.0257	0.423	344
120	-0.009-	-0.0134+	-1.329+	300	165	-0.005-	-0.0259+	-0.397+	345
121	.009	.0138	1.316	301	166	.005	.0260	0.371	346
122	.009	.0142	1.302	302	167	.005	.0261	0.345	347
123	.009	.0146	1.287	303	168	.004	.0262	0.319	348
124	.010	.0150	1.273	304	169	.004	.0263	0.293	349
125	-0.010-	-0.0154+	-1.258+	305	170	-0.004-	-0.0264+	-0.267+	350
126	.010	.0157	1.242	306	171	.003	.0265	0.240	351
127	.010	.0161	1.226	307	172	.003	.0265	0.214	352
128	.010	.0165	1.210	308	173	.002	.0266	0.187	353
129	.010	.0169	1.193	309	174	.002	.0266	0.160	354
130	-0.010-	-0.0172+	-1.176+	310	175	-0.002-	-0.0267+	-0.134+	355
131	.010	.0176	1.159	311	176	.001	.0267	0.107	356
132	.010	.0179	1.141	312	177	.001	.0268	0.080	357
133	.010	.0183	1.123	313	178	- .001-	.0268	0.054	358
134	.010	.0186	1.104	314	179	.000	.0268	-0.027+	359
135	-0.010-	-0.0189+	-1.085+	315	180	0.000	-0.0268+	0.000	360

The sign is to be taken from the same side as the argument.

ILLUMINATED DISK
FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Θ	<i>L</i>	Stellar Mag.	Date	<i>k</i>	<i>i</i>	Θ	<i>L</i>	Stellar Mag.
		°	°					°	°		
Jan. - 3	0.889	39	96	30.3	-0.4	June 30	0.204	126	286	23.5	+1.4
2	.926 ⁺³⁷	32	90	27.3 ^{-3.0}	0.4	July 5	.121 ⁻⁸³	139	291	16.3 ^{-7.2}	1.8
7	.952 ²⁶	25	84	25.6 ^{1.7}	0.4	10	.052 ⁻⁶⁹	154	301	8.1 ^{-8.2}	2.4
12	.971 ¹⁹	19	77	25.1 ^{-0.5}	0.5	15	.013 ^{...}	167	336	2.2 ^{...}	2.9
17	.986 ¹⁵	14	66	25.7 ^{+0.6}	0.7	20	.020 ^{...}	164	53	3.4 ^{...}	2.8
		9		1.8			⁺⁵⁹			^{+9.2}	
22	0.995	8	46	27.5	-0.8	25	0.079	147	78	12.6	+2.0
27	.998 ⁺³	5	338	30.8 ^{+3.3}	1.0	30	.187 ⁺¹⁰⁸	129	87	26.9 ^{+14.3}	1.2
Feb. 1	.991 ⁻⁷	11	281	36.0 ^{5.2}	1.1	Aug. 4	.335 ¹⁴⁸	109	93	42.8 ^{15.9}	+0.6
6	.967 ²⁴	21	263	43.9 ^{7.9}	1.1	9	.516 ¹⁸¹	88	99	57.7 ^{14.9}	-0.1
11	.909 ⁵⁸	35	255	54.4 ^{10.5}	1.1	14	.705 ¹⁸⁹	66	105	67.7 ^{10.0}	0.7
		110		11.2			¹⁵⁸			^{+0.7}	
16	0.799	53	249	65.6	-0.9	19	0.863	43	113	68.4	-1.2
21	.621 ⁻¹⁷⁸	76	245	70.4 ^{+4.8}	-0.6	24	.959 ⁺⁹⁶	23	123	60.7 ^{-7.7}	1.4
26	.395 ²²⁶	102	241	59.4 ^{-11.0}	+0.1	29	.996 ⁺³⁷	8	153	50.2 ^{10.5}	1.5
Mar. 2	.181 ²¹⁴	130	235	33.6 ^{-25.8}	1.0	Sept. 3	.994 ⁻²	9	263	41.2 ^{9.0}	1.3
7	.042 ⁻¹³⁹	156	221	8.6 ^{...}	2.2	8	.974 ²⁰	18	284	34.8 ^{6.4}	0.9
		...		...			²⁸			^{4.2}	
12	0.009	169	124	1.8	+2.9	13	0.946	27	290	30.6	-0.6
17	.067 ^{...}	150	80	11.7 ^{+9.9}	2.0	18	.915 ⁻³¹	34	292	28.2 ^{-2.4}	0.4
22	.170 ⁺¹⁰³	131	71	23.5 ^{11.8}	1.4	23	.880 ³⁵	41	294	27.1 ^{-1.1}	0.2
27	.280 ¹¹⁰	116	68	30.2 ^{6.7}	1.0	28	.841 ³⁹	47	294	27.2 ^{+0.1}	-0.1
Apr. 1	.378 ⁹⁸	104	65	32.4 ^{2.2}	0.8	Oct. 3	.796 ⁴⁵	54	294	28.4 ^{1.2}	0.0
		86		^{+0.3}			⁵⁶			^{2.3}	
6	0.464	94	64	32.7	+0.6	8	0.740	61	294	30.7	+0.1
11	.540 ⁺⁷⁶	85	62	32.6 ^{-0.1}	0.5	13	.670 ⁻⁷⁰	70	293	34.1 ^{+3.4}	0.1
16	.609 ⁶⁹	77	61	32.9 ^{+0.3}	0.3	18	.577 ⁹³	81	293	38.4 ^{4.3}	0.2
21	.676 ⁶⁷	69	61	34.0 ^{1.1}	+0.1	23	.453 ¹²⁴	95	292	42.0 ^{+3.6}	0.4
26	.744 ⁶⁸	61	61	36.5 ^{2.5}	-0.1	28	.290 ¹⁶³	115	292	39.3 ^{-2.7}	0.7
		71		4.3			⁻¹⁷⁹			^{-17.7}	
May 1	0.815	51	61	40.8	-0.4	Nov. 2	0.111	141	294	21.6	+1.5
6	.888 ⁺⁷³	39	63	47.3 ^{+6.5}	0.8	7	.002 ^{...}	175	300	0.5 ^{...}	3.0
11	.956 ⁶⁸	24	66	55.7 ^{8.4}	1.3	12	.076 ^{...}	148	116	17.4 ^{...}	1.6
16	.997 ⁺⁴¹	6	74	64.1 ^{8.4}	1.8	17	.294 ⁺²¹⁸	114	116	50.0 ^{+32.6}	+0.5
21	.985 ⁻¹²	14	248	68.0 ^{+3.9}	1.7	22	.522 ²²⁸	88	115	59.1 ^{+9.1}	-0.2
		72		^{-3.5}			¹⁷¹			^{-6.5}	
26	0.913	34	255	64.5	-1.3	27	0.693	67	113	52.6	-0.4
31	.803 ⁻¹¹⁰	53	260	56.6 ^{-7.9}	0.8	Dec. 2	.806 ⁺¹¹³	52	110	43.4 ^{-9.2}	0.5
June 5	.685 ¹¹⁸	68	266	48.3 ^{8.3}	-0.3	7	.878 ⁷²	41	107	35.9 ^{7.5}	0.5
10	.574 ¹¹¹	81	270	41.7 ^{6.6}	+0.1	12	.924 ⁴⁶	32	102	30.6 ^{5.3}	0.5
15	.474 ¹⁰⁰	93	275	36.8 ^{4.9}	0.5	17	.955 ³¹	25	96	27.3 ^{3.3}	0.5
		93		4.0			²⁰			^{2.0}	
20	0.381	104	278	32.8	+0.8	22	0.975	18	89	25.3	-0.6
25	.291 ⁻⁹⁰	115	282	28.7 ^{-4.1}	1.1	27	.988 ⁺¹³	12	79	24.6 ^{-0.7}	0.6
30	0.204 ⁻⁸⁷	126	286	23.5 ^{-5.2}	+1.4	32	0.996 ⁺⁸	7	59	25.0 ^{+0.4}	-0.8

k is the ratio of the area of the illuminated portion of the apparent disk to the area of the entire apparent disk regarded as circular.

i is the angle between the Sun and Earth, as seen from the planet.

Θ is the position angle of the midpoint of the bright limb, measured eastward from the north point of the disk.

L is the brilliancy of the disk. The unit of *L* is the amount of light received by an eye from a circular disk with the same albedo as the planet, subtending an angular radius of one second of arc, situated at distance unity from the Sun, and illuminated by the latter as the mean disk of the planet is illuminated.

ILLUMINATED DISK
FOR 0^h UNIVERSAL TIME

Date	k	i	Θ	L	Stellar Mag.	Date	k	i	Θ	L	Stellar Mag.
		°	°					°	°		
Jan. - 3	0.703	66.0	106.9	91.6	-3.7	June 30	0.999	3.0	257.0	45.5	-3.5
2	.720	63.8	104.8	87.8	3.6	July 5	.998	4.9	263.7	45.6	3.5
7	.737	61.7	102.6	84.2	3.6	10	.996	6.9	268.1	45.8	3.4
12	.752	59.7	100.1	80.9	3.6	15	.994	8.9	271.7	46.0	3.4
17	.767	57.7	97.5	77.8	3.5	20	.991	10.8	274.9	46.3	3.4
22	0.782	55.7	94.7	74.9	-3.5	25	0.988	12.8	277.6	46.6	-3.4
27	.795	53.8	91.9	72.3	3.5	30	.984	14.8	280.1	46.9	3.4
Feb. 1	.809	51.9	89.0	69.8	3.5	Aug. 4	.979	16.7	282.4	47.3	3.4
6	.821	50.0	86.1	67.5	3.4	9	.974	18.7	284.3	47.8	3.3
11	.834	48.2	83.2	65.4	3.4	14	.968	20.6	286.0	48.3	3.3
16	0.845	46.3	80.4	63.5	-3.4	19	0.962	22.5	287.4	48.8	-3.3
21	.856	44.5	77.7	61.6	3.4	24	.955	24.4	288.6	49.4	3.3
26	.867	42.8	75.1	59.9	3.4	29	.948	26.3	289.6	50.0	3.3
Mar. 2	.877	41.0	72.7	58.4	3.4	Sept. 3	.941	28.2	290.3	50.7	3.3
7	.887	39.2	70.6	56.9	3.3	8	.933	30.1	290.7	51.5	3.3
12	0.897	37.5	68.6	55.6	-3.3	13	0.924	31.9	290.9	52.3	-3.3
17	.906	35.7	66.9	54.4	3.3	18	.916	33.8	290.8	53.3	3.3
22	.915	34.0	65.5	53.3	3.3	23	.907	35.6	290.5	54.2	3.3
27	.923	32.3	64.2	52.2	3.3	28	.897	37.4	289.9	55.3	3.3
Apr. 1	.931	30.5	63.3	51.3	3.3	Oct. 3	.887	39.2	289.1	56.5	3.3
6	0.938	28.8	62.6	50.4	-3.3	8	0.877	41.0	288.0	57.8	-3.3
11	.946	27.0	62.2	49.6	3.3	13	.867	42.8	286.7	59.2	3.4
16	.952	25.2	62.1	48.9	3.3	18	.856	44.6	285.1	60.7	3.4
21	.959	23.5	62.2	48.3	3.3	23	.845	46.4	283.3	62.3	3.4
26	.965	21.7	62.6	47.7	3.3	28	.833	48.2	281.3	64.1	3.4
May 1	0.970	19.9	63.4	47.2	-3.3	Nov. 2	0.821	50.0	279.1	66.0	-3.4
6	.975	18.0	64.4	46.8	3.3	7	.809	51.8	276.7	68.1	3.4
11	.980	16.2	65.7	46.4	3.3	12	.796	53.7	274.2	70.4	3.5
16	.984	14.4	67.3	46.1	3.4	17	.783	55.5	271.7	72.8	3.5
21	.988	12.5	69.2	45.8	3.4	22	.770	57.4	269.1	75.5	3.5
26	0.991	10.6	71.5	45.6	-3.4	27	0.755	59.3	266.6	78.4	-3.5
31	.994	8.7	74.2	45.5	3.4	Dec. 2	.741	61.2	264.0	81.6	3.6
June 5	.996	6.8	77.4	45.4	3.4	7	.726	63.2	261.6	85.0	3.6
10	.998	4.9	81.6	45.3	3.4	12	.710	65.2	259.4	88.8	3.6
15	0.999	3.0	88.1	45.3	3.5	17	.693	67.3	257.2	92.8	3.7
20	1.000	1.1	108.4	45.3	-3.5	22	0.676	69.4	255.3	97.2	-3.7
25	1.000	1.1	236.5	45.4	3.5	27	.658	71.6	253.5	102.1	3.7
30	0.999	3.0	257.0	45.5	-3.5	32	0.639	73.8	251.9	107.3	-3.8

k is the ratio of the area of the illuminated portion of the apparent disk to the area of the entire apparent disk regarded as circular.

i is the angle between the Sun and Earth, as seen from the planet.

Θ is the position angle of the midpoint of the bright limb, measured eastward from the north point of the disk.

L is the brilliancy of the disk. The unit of L is the amount of light received by an eye from a circular disk with the same albedo as the planet, subtending an angular radius of one second of arc, situated at distance unity from the Sun, and illuminated by the latter as the mean disk of the planet is illuminated.

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-Time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
	m		"	°	°	°	°	°
Apr. 2	16.34	+1.3	4.76	59.13	-21.48	-28.73	-12.69	212.70
4	16.26	1.3	4.78	60.76	21.77	29.17	13.12	213.94
6	16.18	1.3	4.81	62.39	22.04	29.61	13.54	215.17
8	16.10	1.3	4.83	64.03	22.30	30.06	13.96	216.41
10	16.02	1.3	4.85	65.68	22.54	30.50	14.38	217.65
12	15.95	+1.3	4.88	67.33	-22.77	-30.94	-14.79	218.89
14	15.87	1.3	4.90	68.99	22.97	31.37	15.19	220.14
16	15.79	1.3	4.93	70.65	23.16	31.81	15.59	221.38
18	15.71	1.3	4.95	72.31	23.33	32.24	15.98	222.63
20	15.63	1.3	4.98	73.98	23.48	32.67	16.37	223.88
22	15.56	+1.2	5.00	75.66	-23.62	-33.10	-16.75	225.14
24	15.48	1.2	5.02	77.33	23.73	33.52	17.12	226.39
26	15.40	1.2	5.05	79.01	23.83	33.94	17.48	227.65
28	15.32	1.2	5.07	80.69	23.91	34.35	17.84	228.91
30	15.25	1.2	5.10	82.36	23.97	34.76	18.19	230.17
May 2	15.17	+1.2	5.13	84.04	-24.01	-35.16	-18.53	231.43
4	15.09	1.2	5.15	85.72	24.03	35.55	18.86	232.69
6	15.02	1.2	5.18	87.39	24.03	35.93	19.19	233.95
8	14.94	1.2	5.21	89.07	24.02	36.31	19.50	235.22
10	14.86	1.2	5.23	90.74	23.98	36.68	19.81	236.48
12	14.79	+1.2	5.26	92.40	-23.93	-37.04	-20.11	237.75
14	14.71	1.2	5.29	94.07	23.86	37.38	20.40	239.01
16	14.64	1.2	5.31	95.73	23.77	37.72	20.67	240.28
18	14.56	1.1	5.34	97.38	23.66	38.05	20.94	241.55
20	14.49	1.1	5.37	99.03	23.54	38.37	21.20	242.82
22	14.41	+1.1	5.40	100.67	-23.40	-38.68	-21.45	244.09
24	14.34	1.1	5.42	102.31	23.24	38.97	21.68	245.36
26	14.26	1.1	5.45	103.94	23.06	39.26	21.91	246.62
28	14.19	1.1	5.48	105.56	22.87	39.53	22.13	247.89
30	14.11	1.1	5.51	107.17	22.66	39.79	22.33	249.16
June 1	14.04	+1.1	5.54	108.78	-22.44	-40.04	-22.52	250.43
3	13.96	1.1	5.57	110.38	22.20	40.27	22.70	251.70
5	13.88	1.1	5.60	111.96	21.94	40.50	22.87	252.97
7	13.81	1.1	5.63	113.54	21.67	40.71	23.03	254.24
9	13.73	1.1	5.66	115.10	21.39	40.90	23.18	255.50
11	13.66	+1.0	5.69	116.66	-21.09	-41.09	-23.31	256.77
13	13.58	1.0	5.73	118.21	20.78	41.27	23.43	258.04
15	13.51	1.0	5.76	119.75	20.45	41.43	23.54	259.30
17	13.43	1.0	5.79	121.27	20.11	41.58	23.64	260.56
19	13.35	1.0	5.82	122.79	19.76	41.72	23.73	261.83
21	13.28	+1.0	5.86	124.29	-19.40	-41.85	-23.80	263.09
23	13.20	1.0	5.89	125.78	19.03	41.96	23.86	264.35
25	13.12	1.0	5.93	127.26	18.64	42.06	23.91	265.61
27	13.05	1.0	5.96	128.73	18.25	42.16	23.95	266.86
29	12.97	1.0	6.00	130.19	17.84	42.24	23.97	268.12
July 1	12.89	+1.0	6.03	131.63	-17.42	-42.31	-23.98	269.37
3	12.81	+1.0	6.07	133.06	-17.00	-42.38	-23.98	270.63

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illum.	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
Apr. 2	0.938	28.78	0.29	247.99	351.07	1.59	351.67	.. ..	0 34.2
4	.937	29.09	0.30	247.71	350.15	341.76	331.85	1 15.0	1 55.8
6	.936	29.39	0.31	247.45	349.23	321.93	312.01	2 36.6	3 17.4
8	.934	29.70	0.32	247.20	348.32	302.09	292.17	3 58.2	4 39.0
10	.933	30.00	0.32	246.97	347.42	282.25	272.32	5 19.8	6 00.6
12	0.932	30.29	0.33	246.75	346.52	262.40	252.47	6 41.5	7 22.3
14	.930	30.59	0.34	246.55	345.63	242.55	232.62	8 03.1	8 44.0
16	.929	30.88	0.35	246.37	344.75	222.69	212.76	9 24.8	10 05.7
18	.928	31.17	0.36	246.20	343.88	202.82	192.89	10 46.5	11 27.4
20	.926	31.46	0.36	246.04	343.02	182.96	173.02	12 08.3	12 49.1
22	0.925	31.75	0.37	245.90	342.16	163.09	153.15	13 30.0	14 10.9
24	.924	32.03	0.38	245.78	341.32	143.21	133.28	14 51.7	15 32.6
26	.923	32.31	0.39	245.68	340.49	123.34	113.40	16 13.5	16 54.4
28	.921	32.59	0.40	245.59	339.68	103.47	93.53	17 35.3	18 16.1
30	.920	32.86	0.41	245.51	338.87	83.59	73.65	18 57.0	19 37.9
May 2	0.919	33.13	0.42	245.45	338.08	63.72	53.78	20 18.8	20 59.7
4	.917	33.40	0.43	245.41	337.30	43.84	33.91	21 40.5	22 21.4
6	.916	33.67	0.43	245.38	336.54	23.97	14.03	23 02.3	23 43.1
8	.915	33.93	0.44	245.37	335.80	4.10	354.16	.. ..	0 24.0
10	.913	34.19	0.45	245.37	335.07	344.23	334.30	1 04.9	1 45.7
12	0.912	34.45	0.46	245.39	334.36	324.37	314.43	2 26.6	3 07.4
14	.911	34.71	0.47	245.42	333.66	304.50	294.58	3 48.3	4 29.1
16	.910	34.96	0.48	245.47	332.99	284.65	274.72	5 10.0	5 50.8
18	.909	35.21	0.49	245.53	332.33	264.80	254.87	6 31.6	7 12.4
20	.907	35.46	0.50	245.61	331.70	244.95	235.03	7 53.2	8 34.1
22	0.906	35.70	0.51	245.70	331.08	225.11	215.19	9 14.9	9 55.6
24	.905	35.94	0.52	245.81	330.49	205.27	195.36	10 36.4	11 17.2
26	.903	36.18	0.53	245.93	329.92	185.44	175.53	11 58.0	12 38.8
28	.902	36.42	0.54	246.07	329.36	165.63	155.72	13 19.5	14 00.2
30	.901	36.65	0.55	246.22	328.84	145.81	135.91	14 41.0	15 21.7
June 1	0.900	36.88	0.55	246.39	328.33	126.01	116.11	16 02.4	16 43.1
3	.899	37.11	0.56	246.57	327.85	106.22	96.33	17 23.8	18 04.5
5	.898	37.33	0.57	246.76	327.39	86.44	76.55	18 45.2	19 25.8
7	.896	37.55	0.58	246.97	326.96	66.66	56.78	20 06.5	20 47.1
9	.895	37.77	0.59	247.19	326.55	46.90	37.02	21 27.7	22 08.4
11	0.894	37.99	0.60	247.42	326.16	27.14	17.27	22 49.0	23 29.6
13	.893	38.20	0.61	247.67	325.80	7.40	357.53	.. ..	0 10.2
15	.892	38.41	0.62	247.93	325.46	347.66	337.80	0 50.7	1 31.3
17	.891	38.62	0.63	248.20	325.15	327.94	318.08	2 11.9	2 52.4
19	.890	38.82	0.64	248.49	324.87	308.23	298.38	3 32.9	4 13.4
21	0.888	39.02	0.65	248.78	324.61	288.53	278.68	4 53.9	5 34.4
23	.887	39.22	0.66	249.09	324.37	268.84	259.00	6 14.9	6 55.4
25	.886	39.41	0.67	249.42	324.16	249.16	239.33	7 35.8	8 16.3
27	.885	39.60	0.68	249.75	323.98	229.49	219.67	8 56.7	9 37.1
29	.884	39.79	0.69	250.10	323.82	209.84	200.02	10 17.5	10 57.9
July 1	0.883	39.97	0.70	250.46	323.68	190.20	180.38	11 38.2	12 18.6
3	0.882	40.15	0.71	250.83	323.57	170.57	160.76	12 58.9	13 39.3

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Light-Time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S	
	m		"	°	°	°	°	°	
July	1	12.89	+1.0	6.03	131.63	-17.42	-42.31	-23.98	269.37
	3	12.81	1.0	6.07	133.06	17.00	42.38	23.98	270.63
	5	12.73	0.9	6.11	134.48	16.57	42.43	23.97	271.88
	7	12.65	0.9	6.15	135.89	16.14	42.47	23.95	273.12
	9	12.57	0.9	6.18	137.29	15.70	42.50	23.91	274.37
	11	12.49	+0.9	6.22	138.67	-15.24	-42.53	-23.86	275.61
	13	12.41	0.9	6.26	140.05	14.78	42.55	23.80	276.86
	15	12.33	0.9	6.31	141.41	14.32	42.56	23.73	278.10
	17	12.25	0.9	6.35	142.76	13.85	42.56	23.65	279.33
	19	12.17	0.9	6.39	144.09	13.37	42.55	23.55	280.57
	21	12.09	+0.9	6.43	145.42	-12.89	-42.54	-23.45	281.80
	23	12.00	0.9	6.48	146.74	12.41	42.52	23.33	283.03
	25	11.92	0.8	6.53	148.04	11.92	42.50	23.20	284.26
	27	11.84	0.8	6.57	149.33	11.43	42.47	23.06	285.48
	29	11.75	0.8	6.62	150.61	10.93	42.43	22.92	286.70
	Aug.	31	11.66	+0.8	6.67	151.88	-10.44	-42.39	-22.76
2		11.58	0.8	6.72	153.14	9.94	42.34	22.59	289.14
4		11.49	0.8	6.77	154.39	9.44	42.29	22.40	290.35
6		11.40	0.8	6.82	155.62	8.94	42.24	22.21	291.56
8		11.31	0.8	6.87	156.85	8.44	42.18	22.02	292.76
10		11.22	+0.8	6.93	158.06	-7.94	-42.11	-21.81	293.97
12		11.14	0.7	6.98	159.26	7.44	42.05	21.59	295.17
14		11.04	0.7	7.04	160.45	6.94	41.98	21.36	296.36
16		10.95	0.7	7.10	161.64	6.44	41.90	21.12	297.56
18		10.86	0.7	7.16	162.81	5.95	41.83	20.88	298.75
20		10.77	+0.7	7.22	163.96	-5.45	-41.75	-20.63	299.93
22		10.67	0.7	7.29	165.11	4.96	41.66	20.37	301.11
24		10.58	0.6	7.35	166.25	4.47	41.57	20.10	302.29
26		10.48	0.6	7.42	167.37	3.99	41.48	19.82	303.47
28		10.39	0.6	7.49	168.49	3.50	41.39	19.54	304.64
Sept.		30	10.29	+0.6	7.56	169.59	-3.02	-41.29	-19.25	305.81
	1	10.19	0.6	7.63	170.68	2.55	41.18	18.95	306.98
	3	10.09	0.6	7.71	171.76	2.09	41.08	18.65	308.14
	5	9.99	0.6	7.78	172.82	1.63	40.97	18.34	309.30
	7	9.89	0.5	7.86	173.88	1.17	40.86	18.02	310.45
	9	9.79	+0.5	7.94	174.92	-0.72	-40.74	-17.70	311.60
	11	9.69	0.5	8.03	175.95	-0.27	40.62	17.37	312.75
	13	9.59	0.5	8.11	176.97	+0.17	40.49	17.03	313.89
	15	9.48	0.5	8.20	177.97	0.60	40.36	16.70	315.03
	17	9.38	0.4	8.29	178.96	1.02	40.22	16.35	316.17
	19	9.27	+0.4	8.39	179.94	+1.43	-40.08	-16.00	317.30
	21	9.17	0.4	8.48	180.90	1.84	39.93	15.65	318.42
	23	9.06	0.4	8.58	181.85	2.23	39.77	15.29	319.55
	25	8.95	0.3	8.68	182.78	2.62	39.60	14.93	320.67
	27	8.85	0.3	8.79	183.69	3.00	39.42	14.56	321.79
	Oct.	29	8.74	+0.3	8.90	184.59	+3.36	-39.24	-14.19	322.90
1		8.63	+0.3	9.01	185.47	+3.72	-39.04	-13.82	324.01

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illum.	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Follow- ing Date	Of Date	Of Follow- ing Date
		°	"	°	°	°	°	h m	h m
July 1	0.883	39.97	0.70	250.46	323.68	190.20	180.38	11 38.2	12 18.6
3	.882	40.15	0.71	250.83	323.57	170.57	160.76	12 58.9	13 39.3
5	.881	40.33	0.72	251.20	323.49	150.96	141.15	14 19.6	14 59.9
7	.880	40.50	0.74	251.59	323.42	131.35	121.55	15 40.2	16 20.5
9	.879	40.67	0.75	251.99	323.39	111.76	101.96	17 00.7	17 41.0
11	0.878	40.84	0.76	252.40	323.38	92.17	82.39	18 21.3	19 01.5
13	.877	41.00	0.77	252.82	323.39	72.60	62.82	19 41.7	20 21.9
15	.876	41.16	0.78	253.24	323.42	53.05	43.27	21 02.1	21 42.3
17	.876	41.31	0.79	253.68	323.48	33.50	23.73	22 22.4	23 02.6
19	.875	41.46	0.80	254.13	323.56	13.97	4.20	23 42.7	...
21	0.874	41.61	0.81	254.58	323.66	354.44	344.68	0 22.9	1 03.0
23	.873	41.75	0.82	255.04	323.78	334.93	325.18	1 43.1	2 23.2
25	.872	41.89	0.83	255.50	323.93	315.43	305.69	3 03.2	3 43.3
27	.871	42.02	0.84	255.98	324.09	295.94	286.20	4 23.3	5 03.4
29	.871	42.15	0.86	256.46	324.28	276.47	266.74	5 43.4	6 23.4
Aug. 31	0.870	42.28	0.87	256.94	324.48	257.01	247.78	7 03.4	7 43.4
2	.869	42.40	0.88	257.43	324.71	237.55	227.83	8 23.4	9 03.3
4	.869	42.51	0.89	257.93	324.95	218.11	208.40	9 43.3	10 23.2
6	.868	42.62	0.90	258.43	325.21	198.68	188.97	11 03.2	11 43.1
8	.867	42.72	0.91	258.93	325.49	179.26	169.56	12 23.0	13 02.9
10	0.867	42.82	0.92	259.44	325.78	159.85	150.15	13 42.7	14 22.6
12	.866	42.91	0.93	259.95	326.10	140.46	130.76	15 02.5	15 42.3
14	.866	43.00	0.95	260.47	326.42	121.07	111.38	16 22.2	17 02.0
16	.865	43.08	0.96	260.98	326.76	101.70	92.01	17 41.8	18 21.6
18	.865	43.16	0.97	261.50	327.12	82.33	72.65	19 01.4	19 41.1
20	0.864	43.23	0.98	262.02	327.49	62.98	53.31	20 20.9	21 00.6
22	.864	43.29	0.99	262.53	327.87	43.64	33.97	21 40.4	22 20.1
24	.864	43.34	1.00	263.05	328.26	24.31	14.65	22 59.8	23 39.5
26	.863	43.39	1.01	263.57	328.66	4.99	355.34	...	0 19.2
28	.863	43.43	1.02	264.08	329.08	345.69	336.04	0 58.8	1 38.5
Sept. 30	0.863	43.46	1.04	264.60	329.50	326.39	316.75	2 18.1	2 57.8
1	.863	43.48	1.05	265.11	329.93	307.11	297.48	3 37.4	4 17.0
3	.863	43.50	1.06	265.61	330.37	287.84	278.21	4 56.6	5 36.2
5	.863	43.50	1.07	266.12	330.82	268.58	258.96	6 15.7	6 55.3
7	.863	43.50	1.08	266.62	331.27	249.34	239.72	7 34.8	8 14.3
9	0.863	43.48	1.09	267.11	331.73	230.10	220.49	8 53.9	9 33.4
11	.863	43.46	1.10	267.60	332.20	210.88	201.27	10 12.8	10 52.3
13	.863	43.42	1.11	268.09	332.67	191.67	182.07	11 31.8	12 11.2
15	.863	43.37	1.12	268.57	333.14	172.47	162.88	12 50.6	13 30.1
17	.864	43.31	1.13	269.04	333.62	153.29	143.71	14 09.5	14 48.8
19	0.864	43.24	1.14	269.50	334.09	134.13	124.55	15 28.2	16 07.5
21	.865	43.16	1.15	269.96	334.57	114.97	105.40	16 46.9	17 26.2
23	.865	43.06	1.16	270.40	335.04	95.84	86.28	18 05.5	18 44.8
25	.866	42.95	1.16	270.84	335.52	76.72	67.16	19 24.0	20 03.3
27	.867	42.82	1.17	271.27	335.99	57.61	48.07	20 42.5	21 21.7
Oct. 29	0.868	42.67	1.18	271.69	336.46	38.52	28.99	22 00.9	22 40.1
1	0.869	42.51	1.18	272.09	336.93	19.45	9.93	23 19.2	23 58.4

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Light-Time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S	
	m		"	°	°	°	°	°	
Oct.	1	8.63	+0.3	9.01	185.47	+3.72	-39.04	-13.82	324.01
	3	8.52	0.2	9.13	186.34	4.07	38.84	13.44	325.11
	5	8.41	0.2	9.25	187.18	4.40	38.62	13.06	326.21
	7	8.30	0.2	9.37	188.01	4.72	38.39	12.68	327.31
	9	8.19	0.2	9.49	188.81	5.03	38.15	12.30	328.40
	11	8.08	+0.1	9.62	189.59	+5.33	-37.89	-11.91	329.49
	13	7.97	0.1	9.76	190.36	5.61	37.61	11.52	330.58
	15	7.86	+0.1	9.90	191.09	5.88	37.32	11.13	331.66
	17	7.75	0.0	10.04	191.81	6.14	37.01	10.73	332.74
	19	7.64	0.0	10.18	192.49	6.37	36.69	10.33	333.82
	21	7.53	0.0	10.33	193.15	+6.60	-36.34	- 9.93	334.89
	23	7.42	-0.1	10.49	193.79	6.81	35.96	9.53	335.96
	25	7.31	0.1	10.65	194.39	7.00	35.57	9.13	337.02
	27	7.20	0.1	10.81	194.96	7.18	35.15	8.73	338.08
	29	7.09	0.2	10.98	195.50	7.33	34.70	8.32	339.14
Nov.	31	6.98	-0.2	11.15	196.00	+7.47	-34.22	- 7.92	340.19
	2	6.87	0.3	11.32	196.47	7.60	33.72	7.51	341.24
	4	6.76	0.3	11.50	196.91	7.70	33.18	7.11	342.28
	6	6.66	0.3	11.68	197.30	7.78	32.61	6.70	343.33
	8	6.55	0.4	11.88	197.66	7.85	32.00	6.29	344.36
	10	6.45	-0.4	12.06	197.97	+7.89	-31.36	- 5.88	345.40
	12	6.35	0.5	12.25	198.24	7.91	30.68	5.47	346.43
	14	6.25	0.5	12.44	198.47	7.91	29.96	5.06	347.46
	16	6.15	0.5	12.64	198.65	7.89	29.19	4.66	348.48
	18	6.06	0.6	12.84	198.78	7.84	28.39	4.25	349.50
	20	5.97	-0.6	13.04	198.86	+7.78	-27.53	- 3.84	350.52
	22	5.88	0.6	13.24	198.89	7.69	26.63	3.43	351.54
	24	5.79	0.7	13.44	198.87	7.58	25.69	3.02	352.55
	26	5.71	0.8	13.63	198.80	7.44	24.69	2.61	353.56
	28	5.63	0.8	13.82	198.68	7.28	23.65	2.21	354.56
Dec.	30	5.55	-0.9	14.01	198.50	+7.09	-22.56	- 1.80	355.56
	2	5.48	0.9	14.20	198.27	6.89	21.41	1.40	356.56
	4	5.41	0.9	14.37	197.99	6.66	20.22	0.99	357.56
	6	5.35	1.0	14.54	197.66	6.41	18.98	0.59	358.55
	8	5.29	1.0	14.70	197.27	6.13	17.70	- 0.19	359.54
	10	5.24	-1.1	14.84	196.84	+5.84	-16.37	+ 0.21	0.52
	12	5.19	1.1	14.98	196.37	5.53	14.99	0.61	1.51
	14	5.15	1.1	15.10	195.85	5.20	13.58	1.01	2.49
	16	5.12	1.2	15.20	195.29	4.86	12.12	1.41	3.46
	18	5.09	1.2	15.28	194.69	4.50	10.64	1.80	4.44
	20	5.07	-1.2	15.35	194.07	+4.13	- 9.12	+ 2.19	5.41
	22	5.05	1.3	15.40	193.42	3.76	7.59	2.59	6.38
	24	5.04	1.3	15.42	192.74	3.38	6.03	2.98	7.34
	26	5.04	1.3	15.42	192.05	3.00	4.46	3.37	8.30
	28	5.05	1.3	15.40	191.35	2.62	2.88	3.75	9.26
30	5.06	-1.3	15.36	190.65	+2.24	- 1.30	+ 4.14	10.22	
32	5.08	-1.3	15.30	189.95	+1.87	+ 0.28	+ 4.52	11.18	

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illum.	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
Oct. 1	0.869	42.51	1.18	272.09	336.93	19.45	9.93	23 19.2	23 58.4
3	.870	42.33	1.19	272.49	337.39	0.40	350.88	0 37.5	1 55.6
5	.871	42.14	1.19	272.87	337.85	341.37	331.86	1 16.6	3 13.7
7	.872	41.92	1.20	273.24	338.30	322.35	312.85	2 34.7	3 31.7
9	.873	41.69	1.20	273.59	338.74	303.36	293.87	3 52.7	4 31.7
11	0.875	41.43	1.20	273.93	339.17	284.39	274.91	5 10.6	5 49.6
13	.876	41.15	1.20	274.26	339.60	265.44	255.97	6 28.5	7 07.3
15	.878	40.85	1.20	274.57	340.01	246.51	237.06	7 46.2	8 25.0
17	.880	40.52	1.20	274.87	340.42	227.61	218.17	9 03.8	9 42.6
19	.882	40.17	1.20	275.15	340.81	208.73	199.30	10 21.4	11 00.1
21	0.884	39.79	1.20	275.41	341.18	189.88	180.47	11 38.7	12 17.4
23	.886	39.38	1.19	275.65	341.55	171.06	161.66	12 56.0	13 34.6
25	.889	38.94	1.18	275.87	341.89	152.27	142.89	14 13.2	14 51.7
27	.891	38.47	1.17	276.07	342.22	133.51	124.14	15 30.2	16 08.6
29	.894	37.96	1.16	276.25	342.53	114.78	105.43	16 47.0	17 25.4
Nov. 31	0.897	37.42	1.15	276.41	342.82	96.09	86.75	18 03.8	18 42.1
2	.900	36.85	1.13	276.54	343.10	77.43	68.11	19 20.3	19 58.5
4	.903	36.24	1.11	276.65	343.35	58.80	49.50	20 36.7	21 14.9
6	.907	35.59	1.09	276.73	343.58	40.22	30.94	21 53.0	22 31.0
8	.910	34.90	1.07	276.78	343.78	21.67	12.41	23 09.1	23 47.0
10	0.914	34.17	1.04	276.81	343.96	3.17	353.93	0 24.9	0 24.9
12	.917	33.40	1.01	276.80	344.11	344.70	335.49	1 02.8	1 40.6
14	.921	32.58	0.98	276.76	344.24	326.28	317.09	2 18.4	2 56.1
16	.925	31.71	0.94	276.69	344.34	307.91	298.75	3 33.8	4 11.4
18	.930	30.79	0.90	276.57	344.41	289.59	280.45	4 49.0	5 26.5
20	0.934	29.82	0.86	276.42	344.44	271.31	262.20	6 04.0	6 41.4
22	.938	28.80	0.82	276.22	344.45	253.09	244.00	7 18.7	7 56.0
24	.943	27.73	0.77	275.97	344.43	234.91	225.85	8 33.3	9 10.5
26	.947	26.60	0.72	275.68	344.37	216.79	207.75	9 47.6	10 24.7
28	.952	25.43	0.67	275.32	344.28	198.72	189.70	11 01.7	11 38.7
Dec. 30	0.956	24.20	0.62	274.90	344.16	180.70	171.71	12 15.6	12 52.4
2	.960	22.91	0.56	274.41	344.00	162.73	153.76	13 29.3	14 06.0
4	.965	21.58	0.50	273.85	343.81	144.81	135.87	14 42.7	15 19.4
6	.969	20.19	0.45	273.18	343.60	126.94	118.02	15 55.9	16 32.5
8	.973	18.76	0.39	272.41	343.35	109.12	100.23	17 09.0	17 45.4
10	0.977	17.28	0.33	271.51	343.07	91.35	82.48	18 21.8	18 58.1
12	.981	15.75	0.28	270.44	342.76	73.62	64.77	19 34.4	20 10.7
14	.985	14.18	0.23	269.16	342.43	55.93	47.10	20 46.9	21 23.0
16	.988	12.59	0.18	267.59	342.07	38.28	29.47	21 59.2	22 35.3
18	.991	10.96	0.14	265.62	341.70	20.67	11.88	23 11.3	23 47.4
20	0.993	9.31	0.10	263.04	341.30	3.09	354.30	0 23.4	0 23.4
22	.995	7.66	0.07	259.47	340.89	345.53	336.75	0 59.3	1 35.3
24	.997	6.03	0.04	254.12	340.47	327.99	319.22	2 11.3	2 47.2
26	.998	4.46	0.02	245.19	340.05	310.46	301.70	3 23.1	3 59.0
28	0.999	3.09	0.01	227.97	339.62	292.94	284.18	4 34.9	5 10.9
30	1.000	2.29	0.01	193.44	339.19	275.42	266.66	5 46.8	6 22.7
32	0.999	2.66	0.01	152.69	338.77	257.90	249.14	6 58.6	7 34.5

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-Time	Stellar Magnitude	Diameter		A_E+180°	D_E	A_S+180°	D_S
			Equat.	Polar				
	m		"	"	°	°	°	°
Jan. 3	51.59	-1.3	31.72	29.60	122.91	-2.58	118.86	-2.69
7	51.36	1.3	31.86	29.74	123.77 ⁺⁸⁶	2.57	119.17	2.68
11	51.11	1.4	32.02	29.89	124.62 ⁸⁵	2.56	119.49	2.67
15	50.83	1.4	32.20	30.05	125.46 ⁸⁴	2.55	119.81	2.67
					83			
19	50.52	-1.4	32.40	30.23	126.29	-2.54	120.13	-2.66
23	50.19	1.4	32.61	30.43	127.10 ⁺⁸¹	2.53	120.45	2.65
27	49.84	1.4	32.84	30.65	127.89 ⁷⁹	2.52	120.77	2.64
31	49.46	1.4	33.09	30.88	128.67 ⁷⁸	2.51	121.09	2.63
Feb. 4	49.06	1.5	33.36	31.13	129.42 ⁷⁵	2.50	121.41	2.62
					73			
8	48.64	-1.5	33.64	31.40	130.15	-2.48	121.73	-2.61
12	48.21	1.5	33.95	31.68	130.85 ⁺⁷⁰	2.47	122.05	2.60
16	47.76	1.5	34.27	31.98	131.52 ⁶⁷	2.46	122.37	2.59
20	47.29	1.5	34.61	32.30	132.17 ⁶⁵	2.45	122.69	2.58
24	46.80	1.6	34.97	32.64	132.79 ⁶²	2.44	123.01	2.57
					59			
28	46.30	-1.6	35.34	32.99	133.38	-2.43	123.33	-2.56
Mar. 3	45.79	1.6	35.73	33.35	133.94 ⁺⁵⁶	2.42	123.65	2.55
7	45.28	1.6	36.14	33.73	134.45 ⁵¹	2.41	123.97	2.55
11	44.75	1.7	36.57	34.13	134.93 ⁴⁸	2.40	124.29	2.54
15	44.22	1.7	37.01	34.54	135.38 ⁴⁵	2.39	124.61	2.53
					40			
19	43.68	-1.7	37.46	34.96	135.78	-2.38	124.93	-2.52
23	43.15	1.7	37.93	35.40	136.14 ⁺³⁶	2.38	125.26	2.51
27	42.61	1.8	38.41	35.85	136.45 ³¹	2.37	125.58	2.50
31	42.07	1.8	38.90	36.30	136.72 ²⁷	2.36	125.90	2.49
Apr. 4	41.54	1.8	39.40	36.77	136.95 ²³	2.36	126.22	2.48
					17			
8	41.02	-1.8	39.90	37.24	137.12	-2.35	126.55	-2.47
12	40.50	1.9	40.41	37.71	137.25 ⁺¹³	2.35	126.87	2.46
16	40.00	1.9	40.92	38.19	137.33 ⁸	2.34	127.19	2.45
20	39.51	1.9	41.43	38.66	137.35 ⁺²	2.34	127.51	2.44
24	39.03	2.0	41.93	39.13	137.33 ⁻²	2.34	127.84	2.43
					7			
28	38.57	-2.0	42.42	39.60	137.26	-2.34	128.16	-2.41
May 2	38.14	2.0	42.91	40.05	137.14 ⁻¹²	2.33	128.48	2.40
6	37.73	2.0	43.38	40.49	136.96 ¹⁸	2.33	128.80	2.39
10	37.34	2.1	43.83	40.91	136.74 ²²	2.33	129.13	2.38
14	36.98	2.1	44.26	41.31	136.48 ²⁶	2.33	129.45	2.37
					31			
18	36.64	-2.1	44.66	41.68	136.17	-2.33	129.78	-2.36
22	36.34	2.1	45.03	42.03	135.83 ⁻³⁴	2.33	130.10	2.35
26	36.07	2.1	45.36	42.34	135.44 ³⁹	2.33	130.43	2.34
30	35.84	2.1	45.66	42.62	135.02 ⁴²	2.33	130.75	2.33
June 3	35.64	2.2	45.91	42.86	134.58 ⁴⁴	2.33	131.08	2.32
					47			
7	35.48	-2.2	46.12	43.05	134.11	-2.33	131.40	-2.30
11	35.36	2.2	46.28	43.20	133.62 ⁻⁴⁹	2.33	131.72	2.29
15	35.28	2.2	46.39	43.30	133.12 ⁵⁰	2.33	132.05	2.28
19	35.23	2.2	46.45	43.35	132.61 ⁵¹	2.33	132.37	2.27
23	35.23	-2.2	46.46	43.36	132.10 ⁻⁵¹	-2.33	132.70	-2.26

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>i</i>	Defect of Illum.	Position Angle of		Central Meridian		
			Defect	Axis	System I	System II	Correction for Phase
	°	"	°	°	°	°	°
Jan. 3	4.05 ⁺⁵⁵	0.04	275.78	4.19	152.33	351.71	+0.07
7	4.60 ⁵³	.05	275.25	3.79	63.20	232.06	.09
11	5.13 ⁵²	.06	274.76	3.40	334.11	112.44	.11
15	5.65 ⁵¹	.08	274.29	3.02	245.04	352.85	.14
19	6.16 ⁺⁴⁹	0.09	273.85	2.64	156.00	233.29	+0.17
23	6.65 ⁴⁷	.11	273.43	2.26	66.99	113.76	.19
27	7.12 ⁴⁵	.13	273.02	1.89	338.01	354.26	.22
31	7.57 ⁴³	.14	272.63	1.53	249.07	234.80	.25
Feb. 4	8.00 ⁴¹	.16	272.26	1.18	160.16	115.36	.28
8	8.41 ⁺³⁸	0.18	271.90	0.84	71.29	355.97	+0.31
12	8.79 ³⁶	.20	271.55	0.51	342.45	236.61	.34
16	9.15 ³³	.22	271.23	0.20	253.65	117.29	.37
20	9.48 ³⁰	.24	270.91	359.89	164.89	358.00	.39
24	9.78 ²⁶	.25	270.61	359.60	76.16	238.76	.42
28	10.04 ⁺²³	0.27	270.32	359.33	347.48	119.55	+0.44
Mar. 3	10.27 ²⁰	.29	270.05	359.07	258.84	0.38	.46
7	10.47 ¹⁶	.30	269.80	358.83	170.23	241.26	.48
11	10.63 ¹²	.31	269.57	358.61	81.67	122.17	.49
15	10.75 ⁸	.32	269.35	358.40	353.16	3.13	.50
19	10.83 ⁺⁴	0.33	269.15	358.21	264.68	244.14	+0.51
23	10.87 ⁻¹	.34	268.96	358.04	176.25	125.18	.51
27	10.86 ⁵	.34	268.80	357.90	87.86	6.27	.51
31	10.81 ¹⁰	.35	268.66	357.77	359.52	247.40	.51
Apr. 4	10.71 ¹⁵	.34	268.53	357.67	271.22	128.58	.50
8	10.56 ⁻¹⁹	0.34	268.43	357.59	182.96	9.80	+0.49
12	10.37 ²⁵	.33	268.35	357.53	94.75	251.07	.47
16	10.12 ²⁹	.32	268.28	357.49	6.58	132.37	.45
20	9.83 ³⁵	.31	268.24	357.48	278.45	13.72	.42
24	9.48 ³⁹	.29	268.21	357.49	190.36	255.11	.39
28	9.09 ⁻⁴⁵	0.27	268.22	357.52	102.32	136.54	+0.36
May 2	8.64 ⁴⁹	.24	268.22	357.58	14.30	18.01	.32
6	8.15 ⁵⁵	.22	268.25	357.66	286.33	259.51	.29
10	7.60 ⁵⁸	.19	268.29	357.76	198.38	141.05	.25
14	7.02 ⁶³	.17	268.35	357.88	110.47	22.61	.21
18	6.39 ⁻⁶⁷	0.14	268.41	358.03	22.58	264.19	+0.18
22	5.72 ⁷¹	.11	268.48	358.19	294.71	145.80	.14
26	5.01 ⁷⁵	.09	268.54	358.37	206.86	27.43	.11
30	4.26 ⁷⁷	.06	268.58	358.56	119.02	269.07	.08
June 3	3.49 ⁷⁹	.04	268.58	358.77	31.18	150.71	.05
7	2.70 ⁻⁸¹	0.03	268.42	358.99	303.35	32.36	+0.03
11	1.89 ⁸³	.01	268.10	359.22	215.51	274.00	+ .01
15	1.06 ⁻⁸³	.00	266.85	359.45	127.67	155.64	.00
19	0.23 ^{..}	.00	255.19	359.69	39.80	37.25	.00
23	0.61 ^{..}	0.00	96.33	359.93	311.92	278.85	0.00

EPIHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-Time	Stellar Magnitude	Diameter		A_E+180°	D_E	A_S+180°	D_S
			Equat.	Polar				
	m		"	"	°	°	°	°
June 23	35.23	-2.2	46.46	43.36	132.10	-2.33	132.70	-2.26
27	35.26	2.2	46.41	43.32	131.59 ⁻⁵¹	2.32	133.03	2.24
July 1	35.33	2.2	46.31	43.23	131.09 ⁵⁰	2.32	133.35	2.23
5	35.45	2.2	46.17	43.09	130.60 ⁴⁹	2.32	133.68	2.22
9	35.60	2.2	45.97	42.91	130.14 ⁴⁶	2.31	134.00	2.21
					44			
13	35.78	-2.2	45.73	42.69	129.70	-2.31	134.33	-2.20
17	36.00	2.1	45.46	42.43	129.30 ⁻⁴⁰	2.30	134.66	2.19
21	36.26	2.1	45.14	42.13	128.92 ³⁸	2.30	134.98	2.17
25	36.55	2.1	44.78	41.80	128.59 ³³	2.29	135.31	2.16
29	36.86	2.1	44.40	41.44	128.29 ³⁰	2.28	135.64	2.15
					25			
Aug. 2	37.21	-2.1	43.99	41.05	128.04	-2.27	135.96	-2.14
6	37.58	2.1	43.55	40.65	127.84 ⁻²⁰	2.26	136.29	2.12
10	37.97	2.0	43.10	40.23	127.68 ¹⁶	2.25	136.62	2.11
14	38.39	2.0	42.63	39.79	127.57 ¹¹	2.24	136.95	2.10
18	38.82	2.0	42.15	39.34	127.51 ⁶	2.23	137.27	2.08
					-1			
22	39.27	-2.0	41.67	38.89	127.50	-2.22	137.60	2.07
26	39.74	1.9	41.18	38.43	127.54 ⁺⁴	2.21	137.93	2.06
30	40.22	1.9	40.69	37.97	127.64 ¹⁰	2.20	138.26	2.04
Sept. 3	40.71	1.9	40.20	37.52	127.78 ¹⁴	2.19	138.59	2.03
7	41.21	1.9	39.71	37.07	127.97 ¹⁹	2.18	138.92	2.02
					23			
11	41.71	-1.8	39.23	36.62	128.20	-2.17	139.25	-2.00
15	42.22	1.8	38.76	36.18	128.48 ⁺²⁸	2.16	139.58	1.99
19	42.73	1.8	38.30	35.75	128.81 ³³	2.15	139.91	1.98
23	43.24	1.8	37.85	35.33	129.19 ³⁸	2.13	140.23	1.96
27	43.74	1.7	37.41	34.92	129.60 ⁴¹	2.12	140.56	1.95
					45			
Oct. 1	44.25	-1.7	36.99	34.52	130.05	-2.10	140.89	-1.94
5	44.74	1.7	36.58	34.14	130.55 ⁺⁵⁰	2.09	141.22	1.92
9	45.23	1.7	36.18	33.77	131.08 ⁵³	2.07	141.55	1.91
13	45.71	1.6	35.80	33.42	131.64 ⁵⁶	2.06	141.88	1.90
17	46.17	1.6	35.44	33.08	132.24 ⁶⁰	2.05	142.21	1.88
					63			
21	46.63	-1.6	35.10	32.76	132.87	-2.03	142.54	-1.87
25	47.07	1.6	34.77	32.45	133.53 ⁺⁶⁶	2.01	142.88	1.85
29	47.49	1.6	34.46	32.16	134.22 ⁶⁹	2.00	143.21	1.84
Nov. 2	47.90	1.5	34.17	31.89	134.94 ⁷²	1.98	143.54	1.82
6	48.28	1.5	33.90	31.64	135.68 ⁷⁴	1.96	143.87	1.81
					77			
10	48.65	-1.5	33.64	31.40	136.45	-1.94	144.20	-1.80
14	49.00	1.5	33.40	31.17	137.23 ⁺⁷⁸	1.92	144.53	1.78
18	49.32	1.5	33.18	30.97	138.04 ⁸¹	1.90	144.86	1.77
22	49.63	1.5	32.98	30.78	138.87 ⁸³	1.88	145.20	1.75
26	49.90	1.5	32.79	30.61	139.71 ⁸⁴	1.86	145.53	1.74
					86			
30	50.16	-1.4	32.63	30.45	140.57	-1.84	145.86	-1.72
Dec. 4	50.39	1.4	32.48	30.31	141.44 ⁺⁸⁷	1.81	146.19	1.71
8	50.59	-1.4	32.35	30.19	142.33 ⁺⁸⁹	-1.79	146.53	-1.69
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EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>i</i>	Defect of Illum.	Position Angle of		Central Meridian		
			Defect	Axis	System I	System II	Correction for Phase
	°	"	°	°	°	°	°
June 23	0.61 ⁺⁸³	0.00	96.33	359.93	311.92	278.85	0.00
27	1.44 ⁸³	.01	93.22	0.17	224.00	160.42	-.01
July 1	2.27 ⁸¹	.02	92.54	0.40	136.06	41.95	.02
5	3.08 ⁷⁸	.03	92.33	0.62	48.07	283.45	.04
9	3.86 ⁷⁷	.05	92.28	0.84	320.04	164.90	.06
13	4.63 ⁺⁷³	0.07	92.31	1.04	231.97	46.30	-0.09
17	5.36 ⁷⁰	.10	92.37	1.23	143.84	287.66	.12
21	6.06 ⁶⁶	.13	92.44	1.41	55.66	168.96	.16
25	6.72 ⁶²	.15	92.52	1.57	327.42	50.20	.20
29	7.34 ⁵⁸	.18	92.60	1.70	239.12	291.38	.24
Aug. 2	7.92 ⁺⁵³	0.21	92.66	1.82	150.77	172.51	-0.27
6	8.45 ⁴⁹	.24	92.71	1.92	62.34	53.57	.31
10	8.94 ⁴⁴	.26	92.75	1.99	333.86	294.57	.35
14	9.38 ³⁸	.28	92.77	2.04	245.32	175.50	.38
18	9.76 ³⁴	.30	92.77	2.07	156.71	56.38	.41
22	10.10 ⁺²⁸	0.32	92.76	2.07	68.04	297.19	-0.44
26	10.38 ²⁴	.34	92.73	2.05	339.32	177.95	.47
30	10.62 ¹⁹	.35	92.67	2.01	250.53	58.65	.49
Sept. 3	10.81 ¹⁴	.36	92.60	1.95	161.69	299.29	.51
7	10.95 ⁹	.36	92.51	1.86	72.80	179.88	.52
11	11.04 ⁺⁵	0.36	92.40	1.75	343.86	60.42	-0.53
15	11.09 ⁰	.36	92.27	1.62	254.87	300.91	.53
19	11.09 ⁻⁵	.36	92.12	1.46	165.83	181.36	.53
23	11.04 ⁸	.35	91.96	1.28	76.74	61.76	.53
27	10.96 ¹²	.34	91.78	1.09	347.62	302.12	.52
Oct. 1	10.84 ⁻¹⁷	0.33	91.58	0.88	258.46	182.44	-0.51
5	10.67 ²⁰	.32	91.36	0.65	169.27	62.73	.50
9	10.47 ²³	.30	91.13	0.40	80.04	302.98	.48
13	10.24 ²⁷	.28	90.89	0.14	350.78	183.21	.46
17	9.97 ³⁰	.27	90.63	359.86	261.50	63.41	.43
21	9.67 ⁻³³	0.25	90.36	359.56	172.19	303.58	-0.41
25	9.34 ³⁶	.23	90.07	359.25	82.86	183.74	.38
29	8.98 ³⁹	.21	89.78	358.93	353.51	63.87	.35
Nov. 2	8.59 ⁴¹	.19	89.47	358.59	264.15	303.99	.32
6	8.18 ⁴³	.17	89.15	358.25	174.77	184.09	.29
10	7.75 ⁻⁴⁶	0.15	88.83	357.89	85.38	64.19	-0.26
14	7.29 ⁴⁷	.13	88.50	357.52	355.98	304.27	.23
18	6.82 ⁵⁰	.12	88.16	357.15	266.58	184.34	.20
22	6.32 ⁵¹	.10	87.81	356.76	177.17	64.41	.17
26	5.81 ⁵²	.08	87.46	356.37	87.75	304.48	.15
30	5.29 ⁻⁵⁴	0.07	87.11	355.97	358.34	184.55	-0.12
Dec. 4	4.75 ⁻⁵⁵	.06	86.76	355.57	268.93	64.62	.10
8	4.20	0.04	86.41	355.16	179.52	304.69	-0.08
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EPHEMERIS FOR PHYSICAL OBSERVATIONS
LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM I												
Day (0 ^h U.T.)	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	°	°	°	°	°	°	°	°	°	°	°	°
2	...	47.1	303.6	158.0	216.6	75.2	136.0	352.6	205.6	258.0	106.2	155.9
3	152.4	204.9	101.5	315.9	14.6	233.2	294.0	150.5	3.4	55.7	263.8	313.5
4	310.1	2.7	259.3	113.8	172.6	31.2	92.0	308.4	161.2	213.4	61.5	111.2
5	107.9	160.4	57.2	271.7	330.6	189.3	250.0	106.2	318.9	11.1	219.2	268.8
6	265.6	318.2	215.0	69.7	128.6	347.3	48.0	264.1	116.7	168.8	16.8	66.5
7	63.3	116.0	12.9	227.6	286.6	145.3	206.0	62.0	274.5	326.5	174.5	224.1
8	221.0	273.8	170.7	25.5	84.6	303.4	4.0	219.9	72.3	124.2	332.1	...
9	18.7	71.6	328.6	183.4	242.6	101.4	162.0	17.8	230.0	281.9	129.8	...
10	176.5	229.4	126.4	341.4	40.6	259.5	320.0	27.8	79.6	79.6	287.5	...
11	334.2	27.2	284.3	139.3	198.6	57.5	117.9	333.5	185.5	237.3	85.1	...
12	132.0	185.0	82.2	297.3	356.7	215.5	275.9	131.3	343.3	34.9	242.8	...
13	289.7	342.8	240.1	95.2	154.7	13.6	73.9	289.2	141.1	192.6	40.4	...
14	87.4	140.6	37.9	253.2	312.7	171.6	231.9	87.1	298.8	350.3	198.1	...
15	245.2	298.4	195.8	51.1	110.7	329.6	29.8	244.9	96.6	148.0	355.8	...
16	42.9	96.2	353.7	209.1	268.7	127.7	187.8	42.8	254.3	305.7	153.4	...
17	200.7	254.0	151.5	7.0	66.7	285.7	345.7	200.6	52.1	103.4	311.1	...
18	358.4	51.8	309.4	165.0	224.7	83.7	143.7	358.4	209.8	261.1	108.7	...
19	156.2	209.7	107.3	323.0	22.8	241.8	301.6	156.3	7.5	58.7	266.4	...
20	313.9	7.5	265.2	120.9	180.8	39.8	99.6	314.1	165.3	216.4	64.0	...
21	111.7	165.3	63.1	278.9	338.8	197.8	257.5	111.9	323.0	14.1	221.7	...
22	269.4	323.1	221.0	76.9	136.8	355.9	55.5	269.8	120.7	171.8	19.3	...
23	67.2	120.9	18.9	234.8	294.9	153.9	213.4	67.6	278.5	329.5	177.0	...
24	225.0	278.8	176.8	32.8	92.9	311.9	11.3	225.4	76.2	127.1	334.6	...
25	22.7	334.7	190.8	348.7	48.9	268.0	327.2	181.0	31.6	82.5	290.0	...
26	180.5	76.6	334.7	190.8	250.9	109.9	169.3	23.2	233.9	284.8	132.3	...
27	338.2	234.4	132.6	348.7	48.9	268.0	327.2	181.0	31.6	82.5	290.0	...
28	136.0	32.3	290.5	146.7	207.0	66.0	125.1	338.8	189.4	240.2	87.6	...
29	293.8	190.1	88.4	304.7	5.0	224.0	283.0	136.6	347.1	37.8	245.3	...
30	91.6	347.9	246.3	102.7	163.0	22.0	81.0	294.4	144.8	195.5	42.9	...
31	249.3	145.8	44.2	260.7	321.1	180.0	238.9	92.2	302.5	353.2	200.6	...
32	...	202.1	58.7	119.1	338.0	36.8	250.0	100.2	150.8	358.2	...	...
33	...	0.0	...	...	277.1	...	194.7	47.8	...	308.5	...	...

MOTION OF THE CENTRAL MERIDIAN

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h
m	°	°	°	°	°	°	°	°	°	°	°	°
0	0.0	36.6	73.2	109.7	146.3	182.9	219.5	256.1	292.7	329.2	5.8	42.4
5	3.0	39.6	76.2	112.8	149.4	186.0	222.5	259.1	295.7	332.3	8.9	45.4
10	6.1	42.7	79.3	115.8	152.4	189.0	225.6	262.2	298.7	335.3	11.9	48.5
15	9.1	45.7	82.3	118.9	155.5	192.1	228.6	265.2	301.8	338.4	15.0	51.5
20	12.2	48.8	85.4	121.9	158.5	195.1	231.7	268.3	304.8	341.4	18.0	54.6
25	15.2	51.8	88.4	125.0	161.6	198.1	234.7	271.3	307.9	344.5	21.1	57.6
30	18.3	54.9	91.5	128.0	164.6	201.2	237.8	274.4	310.9	347.5	24.1	60.7
35	21.3	57.9	94.5	131.1	167.7	204.2	240.8	277.4	314.0	350.6	27.2	63.7
40	24.4	61.0	97.6	134.1	170.7	207.3	243.9	280.5	317.0	353.6	30.2	66.8
45	27.4	64.0	100.6	137.2	173.8	210.3	246.9	283.5	320.1	356.7	33.2	69.8
50	30.5	67.1	103.6	140.2	176.8	213.4	250.0	286.6	323.1	359.7	36.3	72.9
55	33.5	70.1	106.7	143.3	179.9	216.4	253.0	289.6	326.2	2.8	39.3	75.9
60	36.6	73.2	109.7	146.3	182.9	219.5	256.1	292.7	329.2	5.8	42.4	79.0

EPHEMERIS FOR PHYSICAL OBSERVATIONS
LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM II

Day (0 ^h U.T.)	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	...	25.2	60.4	38.2	228.0	210.0	41.9	21.9	358.5	181.9	153.6	334.4
2	...	175.4	210.6	188.5	18.3	0.4	192.3	172.2	148.6	332.0	303.7	124.5
3	351.8	325.5	0.8	338.8	168.7	150.8	342.7	322.5	298.8	122.1	93.7	274.5
4	141.9	115.6	151.1	129.1	319.1	301.2	133.0	112.7	88.9	272.1	243.7	64.5
5	292.0	265.8	301.3	279.4	109.4	91.6	283.4	263.0	239.1	62.2	33.8	214.5
6	82.1	56.0	91.5	69.7	259.8	242.0	73.8	53.3	29.2	212.3	183.8	4.6
7	232.2	206.1	241.7	220.0	50.2	32.4	224.1	203.5	179.4	2.4	333.8	...
8	22.3	356.3	32.0	10.3	200.6	182.8	14.5	353.7	329.5	152.4	123.9	...
9	172.4	146.5	182.2	160.6	350.9	333.2	164.8	144.0	119.6	302.5	273.9	...
10	322.5	296.6	332.4	310.9	141.3	123.6	315.2	294.2	269.7	92.6	63.9	...
11	112.6	86.8	122.7	101.2	291.7	274.0	105.5	84.4	59.9	242.6	214.0	...
12	262.7	236.9	272.9	251.5	82.1	64.4	255.9	234.7	210.0	32.7	4.0	...
13	52.8	27.1	63.2	41.9	232.4	214.8	46.2	24.9	0.1	182.7	154.0	...
14	202.9	177.3	213.4	192.2	22.8	5.2	196.5	175.1	150.2	332.8	304.0	...
15	353.0	327.5	3.6	342.5	173.2	155.6	346.9	325.3	300.4	122.9	94.1	...
16	143.1	117.7	153.9	132.8	323.6	306.0	137.2	115.5	90.5	272.9	244.1	...
17	293.2	267.9	304.2	283.2	114.0	96.4	287.5	265.7	240.6	63.0	34.1	...
18	83.3	58.0	94.4	73.5	264.4	246.8	77.8	56.0	30.7	213.0	184.1	...
19	233.5	208.2	244.7	223.8	54.8	37.3	228.2	206.1	180.8	3.1	334.2	...
20	23.6	358.4	34.9	14.1	205.2	187.6	18.5	356.3	330.9	153.1	124.2	...
21	173.7	148.6	185.2	164.5	355.6	338.0	168.8	146.5	121.0	303.2	274.2	...
22	323.8	298.8	335.4	314.8	145.9	128.4	319.1	296.8	271.1	93.2	64.2	...
23	114.0	89.0	125.7	105.2	296.4	278.8	109.4	86.9	61.2	243.3	214.3	...
24	264.1	239.2	276.0	255.5	86.7	69.2	259.7	237.1	211.3	33.3	4.3	...
25	54.2	29.4	66.2	45.9	237.1	219.6	50.0	27.3	1.4	183.4	154.3	...
26	204.4	179.6	216.5	196.2	27.5	10.0	200.3	177.5	151.5	333.4	304.3	...
27	354.5	329.8	6.8	346.6	177.9	160.4	350.6	327.6	301.6	123.4	94.4	...
28	144.6	120.0	157.1	136.9	328.3	310.8	140.9	117.8	91.7	273.5	244.4	...
29	294.8	270.2	307.4	287.3	118.8	101.2	291.1	268.0	241.8	63.5	34.4	...
30	84.9	...	97.6	77.6	269.2	251.5	81.4	58.2	31.8	213.6	184.4	...
31	235.1	...	247.9	...	59.5	...	231.7	208.3	...	3.6	...	...

MOTION OF THE CENTRAL MERIDIAN

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h
m	°	°	°	°	°	°	°	°	°	°	°	°
0	0.0	36.3	72.5	108.8	145.1	181.3	217.6	253.8	290.1	326.4	2.6	38.9
5	3.0	39.3	75.5	111.8	148.1	184.3	220.6	256.9	293.1	329.4	5.7	41.9
10	6.0	42.3	78.6	114.8	151.1	187.4	223.6	259.9	296.1	332.4	8.7	44.9
15	9.1	45.3	81.6	117.9	154.1	190.4	226.6	262.9	299.2	335.4	11.7	48.0
20	12.1	48.4	84.6	120.9	157.1	193.4	229.7	265.9	302.2	338.5	14.7	51.0
25	15.1	51.4	87.6	123.9	160.2	196.4	232.7	268.9	305.2	341.5	17.7	54.0
30	18.1	54.4	90.7	126.9	163.2	199.4	235.7	272.0	308.2	344.5	20.8	57.0
35	21.2	57.4	93.7	129.9	166.2	202.5	238.7	275.0	311.3	347.5	23.8	60.0
40	24.2	60.4	96.7	133.0	169.2	205.5	241.8	278.0	314.3	350.5	26.8	63.1
45	27.2	63.5	99.7	136.0	172.2	208.5	244.8	281.0	317.3	353.6	29.8	66.1
50	30.2	66.5	102.7	139.0	175.3	211.5	247.8	284.1	320.3	356.6	32.8	69.1
55	33.2	69.5	105.8	142.0	178.3	214.6	250.8	287.1	323.3	359.6	35.9	72.1
60	36.3	72.5	108.8	145.1	181.3	217.6	253.8	290.1	326.4	2.6	38.9	75.1

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

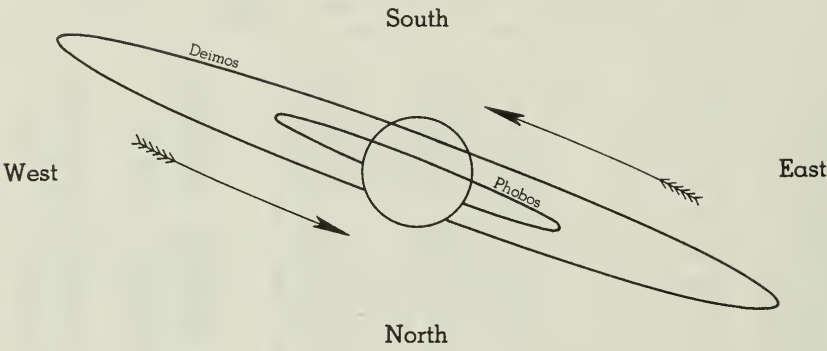
Date	Light-Time	Stellar Magnitude	Diameter		<i>i</i>	Defect of Illum.	Position Angle of Defect
			Equat.	Polar			
	m		"	"	°	"	°
Jan. 31	90.80	+0.8	15.25	13.65	2.57	0.01	265.49
Feb. 4	90.53	.8	15.30	13.69	2.88	.01	265.16
8	90.23	.8	15.35	13.73	3.18	.01	264.87
12	89.90	.8	15.40	13.78	3.47	.01	264.60
16	89.55	+0.8	15.46	13.84	3.75	0.02	264.36
20	89.16	.8	15.53	13.90	4.01	.02	264.13
24	88.76	.8	15.60	13.96	4.26	.02	263.91
28	88.33	.8	15.68	14.03	4.49	.02	263.71
Mar. 3	87.87	.8	15.76	14.10	4.71	.03	263.52
7	87.40	+0.8	15.84	14.18	4.91	0.03	263.35
11	86.91	.8	15.93	14.26	5.08	.03	263.19
15	86.40	.8	16.03	14.34	5.24	.03	263.03
19	85.88	.8	16.13	14.43	5.38	.03	262.89
23	85.35	.8	16.23	14.52	5.49	.04	262.76
27	84.81	+0.8	16.33	14.61	5.58	0.04	262.64
31	84.26	.8	16.44	14.70	5.65	.04	262.53
Apr. 4	83.71	.8	16.54	14.80	5.69	.04	262.43
8	83.16	.8	16.65	14.90	5.71	.04	262.35
12	82.60	.7	16.76	15.00	5.71	.04	262.27
16	82.05	+0.7	16.88	15.10	5.68	0.04	262.20
20	81.50	.7	16.99	15.20	5.62	.04	262.14
24	80.96	.7	17.10	15.31	5.53	.04	262.10
28	80.43	.7	17.22	15.41	5.42	.04	262.06
May 2	79.92	.7	17.33	15.51	5.29	.04	262.03
6	79.42	+0.6	17.44	15.61	5.12	0.03	262.01
10	78.93	.6	17.54	15.70	4.94	.03	262.00
14	78.46	.6	17.65	15.79	4.72	.03	261.99
18	78.02	.6	17.75	15.88	4.49	.03	261.99
22	77.60	.5	17.85	15.97	4.23	.02	261.99
26	77.21	+0.5	17.94	16.05	3.94	0.02	262.00
30	76.84	.5	18.02	16.13	3.64	.02	262.01
June 3	76.51	.5	18.10	16.20	3.32	.01	262.01
7	76.21	.4	18.17	16.26	2.98	.01	262.00
11	75.94	.4	18.24	16.32	2.62	.01	261.97
15	75.70	+0.4	18.29	16.37	2.25	0.01	261.91
19	75.50	.4	18.34	16.41	1.86	.00	261.79
23	75.34	.3	18.38	16.45	1.46	.00	261.55
27	75.22	.3	18.41	16.47	1.06	.00	261.06
July 1	75.14	.3	18.43	16.49	0.65	.00	259.79
5	75.10	+0.3	18.44	16.50	0.24	0.00	253.78
9	75.09	+0.3	18.44	16.50	0.18	0.00	96.03

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-Time	Stellar Magnitude	Diameter		<i>i</i>	Defect of Illum.	Position Angle of Defect
			Equat.	Polar			
	m		"	"	°	"	°
July 5	75.10	+0.3	18.44	16.50	0.24	0.00	253.78
9	75.09	.3	18.44	16.50	0.18	.00	96.03
13	75.13	.3	18.43	16.50	0.59	.00	87.48
17	75.20	.3	18.42	16.48	1.01	.00	86.02
21	75.31	.3	18.39	16.45	1.41	.00	85.46
25	75.47	+0.3	18.35	16.42	1.81	0.00	85.21
29	75.66	.4	18.30	16.38	2.19	.01	85.08
Aug. 2	75.88	.4	18.25	16.33	2.57	.01	85.02
6	76.14	.4	18.19	16.28	2.93	.01	84.99
10	76.44	.4	18.12	16.21	3.27	.01	84.99
14	76.77	+0.4	18.04	16.14	3.60	0.02	85.00
18	77.12	.5	17.96	16.07	3.91	.02	85.01
22	77.51	.5	17.87	15.99	4.19	.02	85.03
26	77.92	.5	17.77	15.90	4.45	.03	85.04
30	78.36	.5	17.67	15.81	4.69	.03	85.05
Sept. 3	78.82	+0.6	17.57	15.72	4.91	0.03	85.06
7	79.30	.6	17.46	15.63	5.10	.03	85.06
11	79.80	.6	17.35	15.53	5.27	.04	85.05
15	80.31	.6	17.24	15.43	5.41	.04	85.03
19	80.84	.6	17.13	15.33	5.52	.04	85.01
23	81.37	+0.7	17.02	15.23	5.61	0.04	84.97
27	81.91	.7	16.91	15.13	5.67	.04	84.93
Oct. 1	82.46	.7	16.79	15.03	5.70	.04	84.87
5	83.01	.7	16.68	14.93	5.71	.04	84.81
9	83.56	.7	16.57	14.83	5.69	.04	84.74
13	84.11	+0.7	16.46	14.73	5.65	0.04	84.65
17	84.66	.7	16.36	14.64	5.59	.04	84.56
21	85.20	.8	16.26	14.55	5.50	.04	84.46
25	85.73	.8	16.16	14.46	5.38	.03	84.35
29	86.24	.8	16.06	14.37	5.25	.03	84.23
Nov. 2	86.74	+0.8	15.97	14.29	5.09	0.03	84.10
6	87.23	.8	15.88	14.21	4.92	.03	83.96
10	87.70	.8	15.79	14.13	4.72	.03	83.82
14	88.15	.8	15.71	14.06	4.51	.02	83.67
18	88.58	.8	15.63	13.99	4.27	.02	83.51
22	88.99	+0.8	15.56	13.93	4.03	0.02	83.34
26	89.37	.8	15.50	13.87	3.76	.02	83.16
30	89.72	.8	15.44	13.81	3.48	.01	82.98
Dec. 4	90.05	.8	15.38	13.76	3.19	.01	82.79
8	90.35	.8	15.33	13.72	2.89	.01	82.60
12	90.62	+0.8	15.28	13.68	2.58	0.01	82.40
..

APPARENT ORBITS OF THE SATELLITES AT DATE OF OPPOSITION,
DECEMBER 30



NAME		SIDEREAL PERIOD		
		h	m	s
I	Phobos	7	39	13.85
II	Deimos	30	17	54.87

DEIMOS

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

d		d		d		d		d	
h		h		h		h		h	
.. ..		Dec. 10	13.3	Dec. 16	20.6	Dec. 23	04.0	Dec. 29	11.2
Dec. 5		11	19.6	18	02.9	24	10.2	30	17.5
6		13	01.8	19	09.2	25	16.5	31	23.7
8		14	08.1	20	15.4	26	22.8	..	..
9		15	14.4	21	21.7	28	05.0	..	..

DEIMOS

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	p_1	F	Time from Eastern Elongation	p_1	F	Time from Eastern Elongation	p_1	F	Time from Eastern Elongation	p_1	F
h m	°		h m	°		h m	°		h m	°	
0 00	69.0	1.000	8 00	202.5	0.128	16 00	250.0	0.985	24 00	50.0	0.277
0 40	69.7	0.991	8 40	227.0	0.242	16 40	250.7	0.951	24 40	56.7	0.401
1 20	70.5	0.962	9 20	235.3	0.367	17 20	251.6	0.900	25 20	60.2	0.521
2 00	71.4	0.916	10 00	239.4	0.489	18 00	252.6	0.832	26 00	62.4	0.632
2 40	72.3	0.852	10 40	241.9	0.603	18 40	253.8	0.748	26 40	64.0	0.732
3 20	73.4	0.773	11 20	243.6	0.706	19 20	255.3	0.650	27 20	65.2	0.819
4 00	74.8	0.679	12 00	244.9	0.796	20 00	257.4	0.541	28 00	66.2	0.890
4 40	76.7	0.572	12 40	246.0	0.872	20 40	260.6	0.423	28 40	67.1	0.944
5 20	79.5	0.456	13 20	246.9	0.931	21 20	266.4	0.298	29 20	67.9	0.980
6 00	84.4	0.333	14 00	247.7	0.972	22 00	280.6	0.175	30 00	68.7	0.998
6 40	95.1	0.209	14 40	248.5	0.995	22 40	331.7	0.093	30 40	69.4	0.997
7 20	130.8	0.107	15 20	249.2	0.999	23 20	32.7	0.156			

Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$
	°	"		°	"		°	"		°	"
Dec. 6	+5.1	50.3	Dec. 12	+4.1	51.8	Dec. 19	+2.8	53.0	Dec. 26	+1.3	53.3
7	4.9	50.6	13	4.0	52.0	20	2.6	53.1	27	1.0	53.3
8	4.8	50.8	14	3.8	52.2	21	2.4	53.2	28	0.8	53.3
9	4.6	51.1	15	3.6	52.4	22	2.2	53.2	29	0.5	53.2
10	+4.5	51.3	16	3.4	52.6	23	1.9	53.3	30	0.3	53.1
11	+4.3	51.6	17	+3.2	52.7	24	+1.7	53.3	31	+0.1	53.0
			18	+3.0	52.9	25	+1.5	53.3	32	-0.1	52.9

Position angle of satellite is $p_1 + p_2$ Apparent distance of satellite is $F \frac{a}{\Delta}$

PHOBOS

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Dec.	d	h	Dec.	d	h	Dec.	d	h	Dec.	d	h		
			10	15.5		16	01.6		21	11.7	26	21.8	
			10	23.2		16	09.2		21	19.3	27	05.4	
	5	13.1				16	16.9		22	03.0	27	13.1	
	5	20.7		11	06.8				22	10.6	27	20.7	
	6	04.4		11	14.5		17	00.6		22	18.3	28	04.4
	6	12.0		11	22.1		17	08.2					
									23	01.9	28	12.0	
	6	19.7		12	05.8		17	15.9		23	09.6	28	19.7
	7	03.3		12	13.5		17	23.5		23	17.2	29	03.3
	7	11.0		12	21.1		18	07.2		24	00.9	29	11.0
	7	18.6		13	04.8		18	14.8		24	08.6	29	18.6
	8	02.3		13	12.4		18	22.5					
									24	16.2	30	02.3	
	8	10.0		13	20.0		19	06.1		24	23.8	30	09.9
	8	17.6		14	03.7		19	13.8		25	07.5	30	17.6
	9	01.3		14	11.3		19	21.4		25	15.2	31	01.2
	9	08.9		14	19.0		20	05.1		25	22.8	31	08.9
	9	16.6		15	02.6		20	12.7					
									26	06.5	31	16.5	
	10	00.2		15	10.3		20	20.4		26	14.1	32	00.2
	10	07.9		15	18.0		21	04.0					

PHOBOS

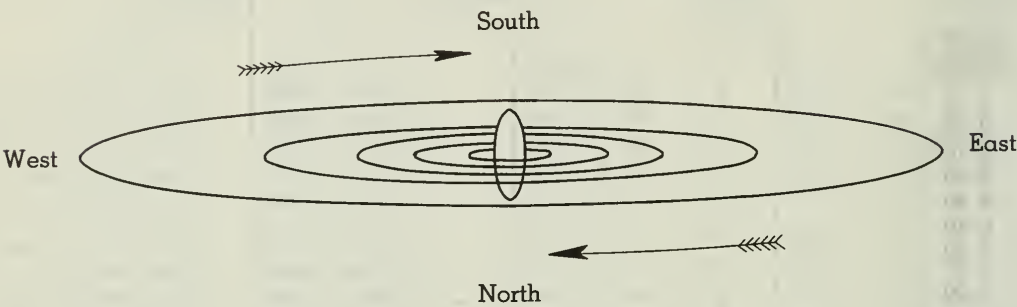
APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	p_1	F	Time from Eastern Elongation	p_1	F	Time from Eastern Elongation	p_1	F	Time from Eastern Elongation	p_1	F
h m	°		h m	°		h m	°		h m	°	
0 00	68.0	1.000	2 00	198.6	0.109	4 00	248.7	0.990	6 00	47.0	0.226
0 10	68.7	0.991	2 10	226.5	0.221	4 10	249.4	0.962	6 10	55.2	0.352
0 20	69.3	0.963	2 20	235.0	0.347	4 20	250.1	0.915	6 20	59.1	0.473
0 30	70.1	0.918	2 30	239.0	0.469	4 30	250.9	0.852	6 30	61.4	0.588
0 40	70.9	0.855	2 40	241.3	0.584	4 40	251.9	0.773	6 40	63.0	0.692
0 50	71.9	0.777	2 50	243.0	0.688	4 50	253.2	0.680	6 50	64.2	0.784
1 00	73.1	0.684	3 00	244.2	0.780	5 00	254.8	0.575	7 00	65.2	0.860
1 10	74.7	0.579	3 10	245.1	0.858	5 10	257.3	0.460	7 10	66.0	0.922
1 20	77.2	0.464	3 20	246.0	0.920	5 20	261.5	0.337	7 20	66.7	0.966
1 30	81.2	0.342	3 30	246.7	0.964	5 30	270.6	0.212	7 30	67.4	0.992
1 40	90.0	0.217	3 40	247.4	0.991	5 40	301.9	0.102	7 40	68.1	1.000
1 50	119.6	0.105	3 50	248.0	1.000	5 50	20.6	0.113			

Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$
	°	"		°	"		°	"		°	"
Dec. 6	4.7	20.1	Dec. 12	+3.8	20.7	Dec. 19	+2.5	21.2	Dec. 26	+1.0	21.3
7	4.5	20.2	13	3.6	20.8	20	2.3	21.2	27	0.8	21.3
8	4.4	20.3	14	3.5	20.9	21	2.1	21.2	28	0.5	21.3
9	4.2	20.4	15	3.3	20.9	22	1.9	21.3	29	0.3	21.3
10	+4.1	20.5	16	3.1	21.0	23	1.6	21.3	30	+0.1	21.2
11	+3.9	20.6	17	+2.9	21.1	24	+1.4	21.3	31	-0.1	21.2
			18	+2.7	21.1	25	+1.2	21.3	32	-0.3	21.1

Position angle of satellite is p_1+p_2 .

Apparent distance of satellite is $F\frac{a}{\Delta}$



NAME		MEAN SYNODIC PERIOD					NAME	SIDEREAL PERIOD
		d	h	m	s	d		d
V		0	11	57	27.619	= 0.498 236 33	X	254
I	Io	1	18	28	35.946	= 1.769 860 49	XII	631
II	Europa	3	13	17	53.736	= 3.554 094 17	XI	692
III	Ganymede	7	03	59	35.856	= 7.166 387 22	VIII	739
IV	Callisto	16	18	05	06.916	= 16.753 552 27	IX	758
VI		266.00						
VII		276.67						

SATELLITE V

UNIVERSAL TIME OF EVERY TWENTIETH GREATEST ELONGATION

Eastern Elongation					Western Elongation				
	d	h		d h		d h		d h	
Apr.	1	12.7	June	30 04.6	Apr.	1 18.7	June	30 10.5	
	11	11.8		10 03.7		11 17.8		10 09.6	
	21	11.0		20 02.8		21 16.9		20 08.7	
May	1	10.1	Aug.	30 01.9	May	1 16.0	Aug.	30 07.8	
	11	09.2		9 01.0		11 15.1		9 07.0	
	21	08.2		19 00.1		21 14.2		19 06.1	
June	31	07.3	Sept.	28 23.3	June	31 13.3	Sept.	29 05.3	
	10	06.4		7 22.4		10 12.4		8 04.4	
	20	05.5		.. ..		20 11.5		.. ..

MULTIPLES OF THE MEAN SYNODIC PERIOD

	d	h		d	h		d	h		d	h
1	0	12.0	6	2	23.7	11	5	11.5	16	7	23.3
2	0	23.9	7	3	11.7	12	5	23.5	17	8	11.3
3	1	11.9	8	3	23.7	13	6	11.4	18	8	23.2
4	1	23.8	9	4	11.6	14	6	23.4	19	9	11.2
5	2	11.8	10	4	23.6	15	7	11.4	20	9	23.2

DIFFERENTIAL COORDINATES OF SATELLITE VI FOR 0^h U.T.

Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$	Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$	Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$
	m s	'		m s	'		m s	'
Feb. 4	+1 12	-17.9	May 10	-4 20	+28.9	Aug. 18	+2 34	-10.8
8	0 58	16.7	14	4 22	30.2	22	2 44	13.6
12	0 44	15.4	18	4 21	31.3	26	2 50	16.1
16	0 30	13.9	22	4 19	32.2	30	2 54	18.3
			26	4 14	32.9	Sept. 3	2 55	20.1
20	+0 15	-12.2	30	-4 06	+33.4	7	+2 54	-21.6
24	-0 01	10.4	June 3	3 56	33.6	11	2 50	22.7
28	0 17	8.5	7	3 44	33.5	15	2 43	23.4
Mar. 3	0 34	6.4	11	3 30	33.1	19	2 34	23.7
7	0 51	4.3	15	3 13	32.4	23	2 24	23.6
11	-1 08	- 2.1	19	-2 54	+31.4	27	+2 12	-23.2
15	1 25	+ 0.1	23	2 33	30.0	Oct. 1	1 59	22.5
19	1 42	2.3	27	2 10	28.3	5	1 45	21.5
23	1 59	4.6	July 1	1 47	26.3	9	1 31	20.2
27	2 15	6.9	5	1 22	24.0	13	1 16	18.8
31	-2 31	+ 9.2	9	-0 56	+21.5	17	+1 00	-17.2
Apr. 4	2 47	11.4	13	0 30	18.7	21	0 45	15.4
8	3 02	13.7	17	-0 05	15.7	25	0 29	13.6
12	3 16	15.9	21	+0 20	12.5	29	+0 14	11.6
16	3 29	18.0	25	0 45	9.1	Nov. 2	-0 01	9.6
20	-3 42	+20.1	29	+1 08	5.7	6	-0 16	- 7.6
24	3 53	22.0	Aug. 2	1 29	+ 2.2	10	0 30	5.6
28	4 02	23.9	6	1 49	- 1.2	14	0 44	3.6
May 2	4 10	25.7	10	2 07	4.5	18	-0 57	- 1.7
6	-4 16	+27.4	14	+2 22	- 7.7	..	. . .	. . .

DIFFERENTIAL COORDINATES OF SATELLITE VII FOR 0^h U.T.

Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$	Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$	Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$
	m s	'		m s	'		m s	'
Feb. 4	-2 48	- 1.5	May 10	+3 50	+10.9	Aug. 18	+0 37	-30.8
8	2 50	+ 0.9	14	4 09	8.7	22	+0 14	29.9
12	2 50	3.2	18	4 25	6.4	26	-0 08	28.8
16	2 48	5.3	22	4 39	3.9	30	0 29	27.5
			26	4 51	+ 1.4	Sept. 3	0 49	26.0
20	-2 44	+ 7.4	30	+5 01	- 1.2	7	-1 08	-24.4
24	2 37	9.5	June 3	5 08	3.8	11	1 26	22.7
28	2 28	11.5	7	5 12	6.4	15	1 42	20.8
Mar. 3	2 16	13.4	11	5 14	9.0	19	1 57	18.9
7	2 02	15.1	15	5 13	11.5	23	2 11	16.9
11	-1 46	+16.5	19	+5 09	-14.0	27	-2 23	-14.7
15	1 28	17.7	23	5 03	16.4	Oct. 1	2 33	12.6
19	1 08	18.7	27	4 55	18.7	5	2 41	10.4
23	0 47	19.5	July 1	4 44	21.0	9	2 48	8.1
27	0 26	20.1	5	4 31	23.1	13	2 53	5.7
31	-0 03	+20.5	9	+4 16	-25.0	17	-2 57	- 3.4
Apr. 4	+0 20	20.6	13	3 59	26.7	21	2 58	- 1.1
8	0 44	20.5	17	3 40	28.3	25	2 57	+ 1.2
12	1 08	20.1	21	3 19	29.6	29	2 54	3.5
16	1 32	19.5	25	2 57	30.7	Nov. 2	2 50	5.7
20	+1 57	+18.7	29	+2 34	-31.5	6	-2 43	+ 7.7
24	2 21	17.6	Aug. 2	2 11	32.0	10	2 34	9.6
28	2 45	16.3	6	1 47	32.1	14	2 24	11.3
May 2	3 08	14.7	10	1 23	31.9	18	-2 12	+12.7
6	+3 30	+12.9	14	+1 00	-31.5	..	. . .	. . .

UNIVERSAL TIME OF SUPERIOR GEOCENTRIC CONJUNCTION

SATELLITE I

Jan.	d	h	m	Mar.	d	h	m	June	d	h	m	Sept.	d	h	m
	1	09	56		28	03	58		22	19	47		17	11	58
	3	04	27		29	22	26		24	14	13		19	06	26
	4	22	57		31	16	54		26	08	39		21	00	55
	6	17	27	Apr.	2	11	22		28	03	05		22	19	24
	8	11	57		4	05	50		29	21	31		24	13	53
	10	06	28		6	00	18	July	1	15	57		26	08	22
	12	00	58		7	18	46		3	10	23		28	02	51
	13	19	28		9	13	14		5	04	49	Oct.	29	21	20
	15	13	58		11	07	41		6	23	15		1	15	50
Feb.	17	08	28		13	02	09		8	17	41		3	10	19
	19	02	58		14	20	36		10	12	08		5	04	48
	20	21	28		16	15	04		12	06	34		6	23	18
	22	15	58		18	09	31		14	01	00		8	17	47
	24	10	28		20	03	59		15	19	26		10	12	16
	26	04	58		21	22	26		17	13	53		12	06	46
	27	23	28		23	16	53		19	08	19		14	01	16
	29	17	58		25	11	20		21	02	46		15	19	45
	31	12	28		27	05	47		22	21	12		17	14	15
	2	06	58		29	00	14	Aug.	24	15	39		19	08	45
Mar.	4	01	27		30	18	41		26	10	05		21	03	14
	5	19	57	May	2	13	08		28	04	32		22	21	44
	7	14	27		4	07	35		29	22	59		24	16	14
	9	08	56		6	02	02		31	17	26		26	10	44
	11	03	26		7	20	28		2	11	53		28	05	14
	12	21	55		9	14	55		4	06	20		29	23	44
	14	16	25		11	09	22		6	00	47	Nov.	31	18	14
	16	10	54		13	03	48		7	19	14		2	12	44
	18	05	24		14	22	15		9	13	41		4	07	14
	19	23	53		16	16	41		11	08	08		6	01	44
	21	18	23		18	11	07		13	02	36		7	20	14
	23	12	52		20	05	34		14	21	03		9	14	44
	25	07	21		22	00	00		16	15	31		11	09	14
	27	01	50		23	18	26		18	09	58		13	03	44
Mar.	28	20	19		25	12	52		20	04	26		14	22	14
	1	14	49		27	07	18		21	22	53		16	16	45
	3	09	18		29	01	44		23	17	21		18	11	15
	5	03	47		30	20	10		25	11	49		20	05	45
	6	22	15	June	1	14	36		27	06	17		22	00	16
	8	16	44		3	09	02		29	00	45		23	18	46
	10	11	13		5	03	28		30	19	13		25	13	16
	12	05	42		6	21	54	Sept.	1	13	41		27	07	47
	14	00	11		8	16	20		3	08	10		29	02	17
	15	18	39		10	10	46		5	02	38		30	20	48
	17	13	08		12	05	12		6	21	06	Dec.	2	15	18
	19	07	36		13	23	38		8	15	35		4	09	48
	21	02	05		15	18	04		10	10	03		6	04	19
	22	20	33		17	12	30		12	04	32		7	22	49
	24	15	02		19	06	56		13	23	00		9	17	20
	26	09	30		21	01	22		15	17	29		..	..	..

UNIVERSAL TIME OF SUPERIOR GEOCENTRIC CONJUNCTION

SATELLITE II

Jan.	d	h	m	Mar.	d	h	m	June	d	h	m	Sept.	d	h	m
	2	10	26	Apr.	31	08	10	July	28	01	42		24	20	18
	5	23	50		3	21	26		1	14	50		28	09	39
	9	13	13		7	10	42		5	03	59	Oct.	1	22	59
	13	02	37		10	23	57		8	17	07		5	12	20
	16	16	00		14	13	12		12	06	16		9	01	41
	20	05	23		18	02	26		15	19	25		12	15	03
	23	18	46		21	15	40		19	08	35		16	04	24
	27	08	09		25	04	53		22	21	45		19	17	47
Feb.	30	21	31		28	18	05		26	10	56		23	07	09
	3	10	54	May	2	07	18		30	00	06		26	20	32
	7	00	16		5	20	29	Aug.	2	13	18		30	09	55
	10	13	38		9	09	41		6	02	30	Nov.	2	23	19
	14	02	59		12	22	51		9	15	43		6	12	42
	17	16	21		16	12	01		13	04	56		10	02	06
	21	05	42		20	01	11		16	18	10		13	15	29
	24	19	03		23	14	21		20	07	24		17	04	54
Mar.	28	08	23		27	03	29		23	20	40		20	18	18
	2	21	43		30	16	38		27	09	55		24	07	42
	6	11	03	June	3	05	46		30	23	11		27	21	06
	10	00	22		6	18	55	Sept.	3	12	28	Dec.	1	10	31
	13	13	41		10	08	02		7	01	45		4	23	55
	17	03	00		13	21	11		10	15	02		8	13	20
	20	16	18		17	10	18		14	04	21		..	..	..
	24	05	36		20	23	26		17	17	39				
	27	18	53		24	12	34		21	06	59				

SATELLITE III

Jan.	d	h	m	Apr.	d	h	m	July	d	h	m	Oct.	d	h	m
	2	17	25		5	00	14		6	21	10		7	21	46
	9	21	52		12	04	03		14	00	30		15	01	59
	17	02	17		19	07	48		21	03	53		22	06	15
	24	06	40		26	11	27		28	07	20		29	10	33
	31	11	02	May	3	15	02	Aug.	4	10	51	Nov.	5	14	54
Feb.	7	15	22		10	18	33		11	14	25		12	19	17
	14	19	40		17	22	00		18	18	05		19	23	41
	21	23	55		25	01	24		25	21	49		27	04	08
	29	04	08	June	1	04	44	Sept.	2	01	39	Dec.	4	08	36
Mar.	7	08	16		8	08	03		9	05	32		..	..	..
	14	12	21		15	11	19		16	09	30				
	21	16	23		22	14	35		23	13	32				
	28	20	20		29	17	52		30	17	37				

SATELLITE IV

Jan.	d	h	m	Apr.	d	h	m	July	d	h	m	Oct.	d	h	m
	0	08	03		10	03	30		18	21	44		27	06	27
	17	04	33		26	20	06	Aug.	4	12	57	Nov.	13	02	28
Feb.	3	00	44	May	13	11	46		21	05	05		29	22	54
	19	20	27		30	02	37	Sept.	6	22	09		..	..	..
Mar.	7	15	34	June	15	16	58		23	16	09				
	24	09	58	July	2	07	11	Oct.	10	10	58				

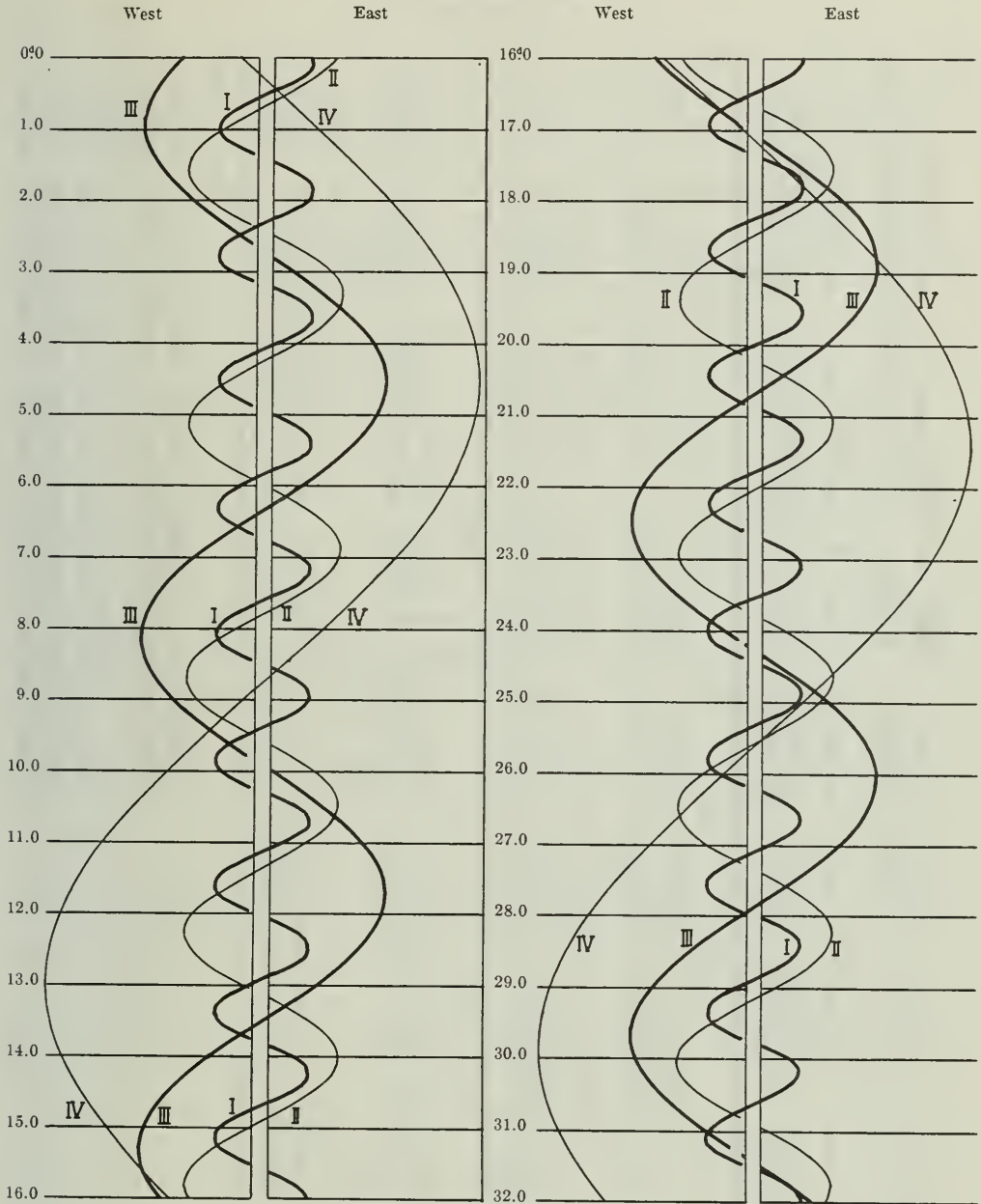
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

JANUARY

d h m		d h m		d h m		d h m	
0 11 07	I. Sh.I.	8 10 17	I. Ec.D.	16 22 07	III. Ec.D.	25 5 44	I. Sh.I.
11 32	I. Tr.I.	13 04	I. Oc.R.			6 32	I. Tr.I.
13 18	I. Sh.E.			17 0 46	III. Ec.R.	7 55	I. Sh.E.
13 44	I. Tr.E.	9 7 29	I. Sh.I.	0 54	III. Oc.D.	8 43	I. Tr.E.
13 50	II. Sh.I.	8 03	I. Tr.I.	3 39	III. Oc.R.	10 57	II. Sh.I.
14 43	II. Tr.I.	9 40	I. Sh.E.	6 39	I. Ec.D.	12 35	II. Tr.I.
16 18	II. Sh.E.	10 14	I. Tr.E.	9 34	I. Oc.R.	13 26	II. Sh.E.
17 13	II. Tr.E.	10 50	II. Ec.D.			15 07	II. Tr.E.
		14 28	II. Oc.R.	18 3 51	I. Sh.I.		
1 8 23	I. Ec.D.	18 09	III. Ec.D.	4 33	I. Tr.I.	26 3 02	I. Ec.D.
11 03	I. Oc.R.	23 14	III. Oc.R.	6 01	I. Sh.E.	6 04	I. Oc.R.
				6 44	I. Tr.E.		
2 5 35	I. Sh.I.	10 4 45	I. Ec.D.	8 21	II. Sh.I.	27 0 12	I. Sh.I.
6 02	I. Tr.I.	7 34	I. Oc.R.	9 47	II. Tr.I.	1 02	I. Tr.I.
7 46	I. Sh.E.			10 50	II. Sh.E.	2 23	I. Sh.E.
8 14	I. Tr.E.	11 1 57	I. Sh.I.	12 19	II. Tr.E.	3 13	I. Tr.E.
8 17	II. Ec.D.	2 33	I. Tr.I.			5 14	II. Ec.D.
11 41	II. Oc.R.	4 08	I. Sh.E.	19 1 08	I. Ec.D.	9 25	II. Oc.R.
14 11	III. Ec.D.	4 44	I. Tr.E.	4 04	I. Oc.R.	16 07	III. Sh.I.
18 47	III. Oc.R.	5 45	II. Sh.I.	22 19	I. Sh.I.	18 46	III. Sh.E.
		6 58	II. Tr.I.	23 02	I. Tr.I.	19 30	III. Tr.I.
3 2 51	I. Ec.D.	8 14	II. Sh.E.			21 30	I. Ec.D.
5 33	I. Oc.R.	9 30	II. Tr.E.	20 0 30	I. Sh.E.	22 15	III. Tr.E.
		23 14	I. Ec.D.	1 14	I. Tr.E.		
4 0 04	I. Sh.I.			2 40	II. Ec.D.	28 0 34	I. Oc.R.
0 33	I. Tr.I.	12 2 04	I. Oc.R.	6 39	II. Oc.R.	18 41	I. Sh.I.
2 14	I. Sh.E.	20 25	I. Sh.I.	12 09	III. Sh.I.	19 31	I. Tr.I.
2 44	I. Tr.E.	21 03	I. Tr.I.	14 47	III. Sh.E.	20 52	I. Sh.E.
3 09	II. Sh.I.	22 36	I. Sh.E.	15 08	III. Tr.I.	21 43	I. Tr.E.
4 08	II. Tr.I.	23 14	I. Tr.E.	17 52	III. Tr.E.		
5 37	II. Sh.E.			19 36	I. Ec.D.	29 0 15	II. Sh.I.
6 39	II. Tr.E.	13 0 07	II. Ec.D.	22 34	I. Oc.R.	1 59	II. Tr.I.
21 20	I. Ec.D.	3 52	II. Oc.R.			2 44	II. Sh.E.
		8 11	III. Sh.I.	21 16 47	I. Sh.I.	4 31	II. Tr.E.
5 0 03	I. Oc.R.	10 43	III. Tr.I.	17 32	I. Tr.I.	15 59	I. Ec.D.
18 32	I. Sh.I.	10 48	III. Sh.E.	18 58	I. Sh.E.	19 04	I. Oc.R.
19 03	I. Tr.I.	13 27	III. Tr.E.	19 44	I. Tr.E.		
20 43	I. Sh.E.	17 42	I. Ec.D.	21 39	II. Sh.I.	30 13 09	I. Sh.I.
21 14	I. Tr.E.	20 34	I. Oc.R.	23 11	II. Tr.I.	14 01	I. Tr.I.
21 33	II. Ec.D.					15 20	I. Sh.E.
		14 14 54	I. Sh.I.	22 0 08	II. Sh.E.	16 13	I. Tr.E.
6 1 05	II. Oc.R.	15 33	I. Tr.I.	1 43	II. Tr.E.	18 30	II. Ec.D.
4 13	III. Sh.I.	17 05	I. Sh.E.	14 05	I. Ec.D.	22 47	II. Oc.R.
6 18	III. Tr.I.	17 44	I. Tr.E.	17 04	I. Oc.R.		
6 49	III. Sh.E.	19 03	II. Sh.I.			31 6 03	III. Ec.D.
9 01	III. Tr.E.	20 22	II. Tr.I.	23 11 16	I. Sh.I.	8 43	III. Ec.R.
15 48	I. Ec.D.	21 32	II. Sh.E.	12 02	I. Tr.I.	9 39	III. Oc.D.
18 33	I. Oc.R.	22 54	II. Tr.E.	13 26	I. Sh.E.	10 27	I. Ec.D.
				14 14	I. Tr.E.	12 26	III. Oc.R.
7 13 00	I. Sh.I.	15 12 11	I. Ec.D.	15 57	II. Ec.D.	13 34	I. Oc.R.
13 33	I. Tr.I.	15 04	I. Oc.R.	20 02	II. Oc.R.		
15 11	I. Sh.E.						
15 44	I. Tr.E.	16 9 22	I. Sh.I.	24 2 05	III. Ec.D.		
16 27	II. Sh.I.	10 03	I. Tr.I.	4 45	III. Ec.R.		
17 33	II. Tr.I.	11 33	I. Sh.E.	5 17	III. Oc.D.		
18 55	II. Sh.E.	12 14	I. Tr.E.	8 03	III. Oc.R.		
20 04	II. Tr.E.	13 23	II. Ec.D.	8 33	I. Ec.D.		
		17 15	II. Oc.R.	11 34	I. Oc.R.		
I. Jan. 17		II. Jan. 16		III. Jan. 16-17		IV	
$x_1 = -1.6, y_1 = -0.3$		$x_1 = -1.8, y_1 = -0.5$		$x_1 = -2.3, y_1 = -0.6$ $x_2 = -0.8, y_2 = -0.6$		No eclipse	

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JANUARY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W</p> <div data-bbox="252 1474 343 1537"> </div>	<p>III W</p> <div data-bbox="734 1474 848 1537"> </div>	<p>E</p>
<p>II W</p> <div data-bbox="252 1565 343 1628"> </div>	<p>IV W</p> <p>No eclipse</p>	<p>E</p>

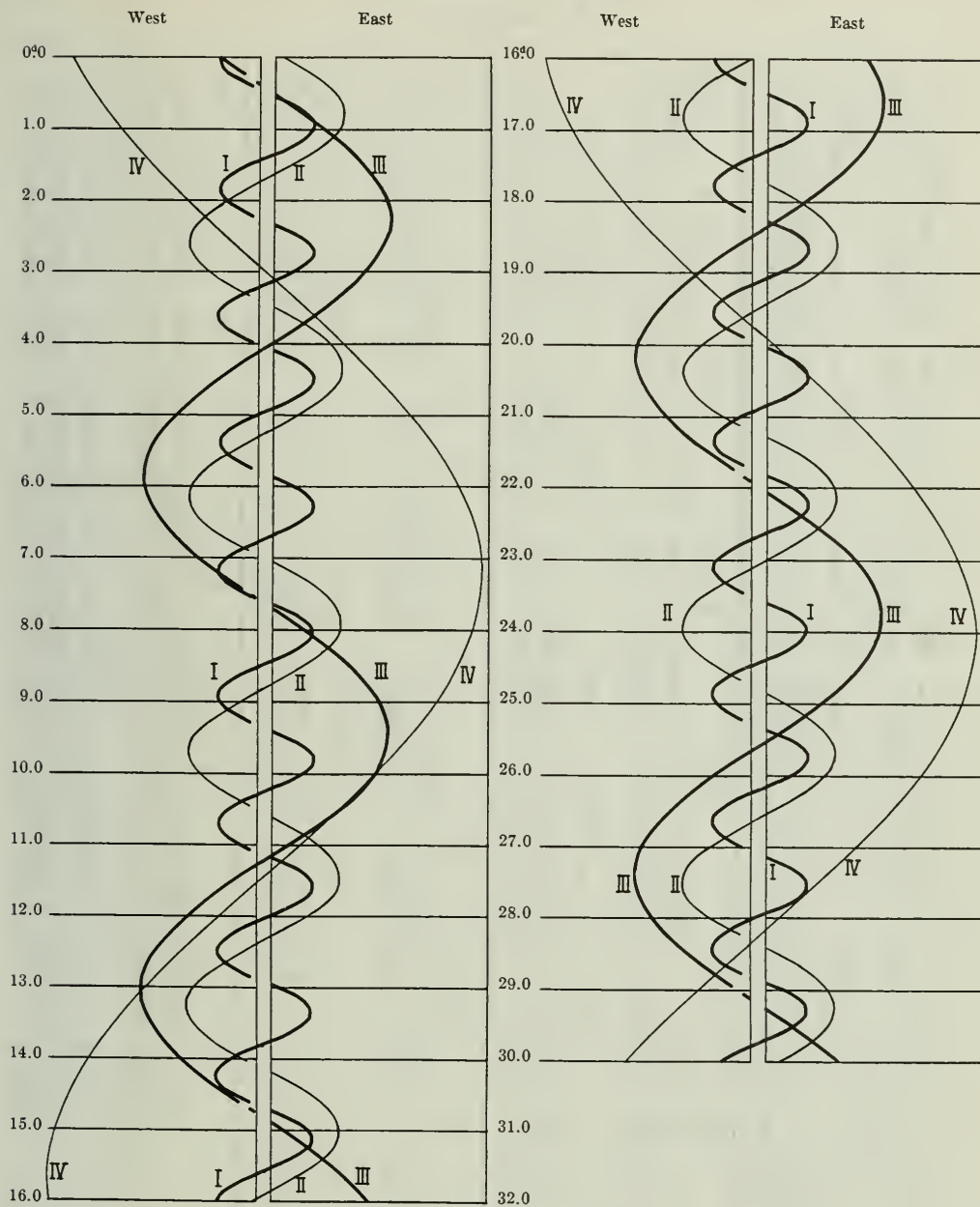
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

FEBRUARY




d	h	m		d	h	m		d	h	m		d	h	m	
1	7	37	I. Sh.I.	8	20	41	II. Tr.E.	17	8	03	I. Sh.E.	25	8	28	I. Oc.R.
	8	31	I. Tr.I.						9	08	I. Tr.E.		10	40	III. Sh.E.
	9	48	I. Sh.E.	9	6	49	I. Ec.D.		12	54	II. Ec.D.		12	37	III. Tr.I.
	10	42	I. Tr.E.		10	03	I. Oc.R.		17	38	II. Oc.R.		15	25	III. Tr.E.
	13	33	II. Sh.I.					18	3	11	I. Ec.D.	26	2	14	I. Sh.I.
	15	22	II. Tr.I.	10	3	59	I. Sh.I.		4	00	III. Sh.I.		3	23	I. Tr.I.
	16	02	II. Sh.E.		4	59	I. Tr.I.		6	30	I. Oc.R.		4	25	I. Sh.E.
	17	55	II. Tr.E.		6	10	I. Sh.E.		6	40	III. Sh.E.		5	34	I. Tr.E.
					7	10	I. Tr.E.		8	23	III. Tr.I.		10	37	II. Sh.I.
2	4	56	I. Ec.D.		10	21	II. Ec.D.		11	10	III. Tr.E.		12	56	II. Tr.I.
	8	04	I. Oc.R.		14	54	II. Oc.R.						13	07	II. Sh.E.
								19	0	21	I. Sh.I.		15	29	II. Tr.E.
3	2	06	I. Sh.I.	11	0	02	III. Sh.I.		1	26	I. Tr.I.		23	33	I. Ec.D.
	3	01	I. Tr.I.		1	18	I. Ec.D.		2	32	I. Sh.E.				
	4	17	I. Sh.E.		2	42	III. Sh.E.		3	38	I. Tr.E.	27	2	57	I. Oc.R.
	5	12	I. Tr.E.		4	08	III. Tr.I.		8	02	II. Sh.I.		20	42	I. Sh.I.
	7	47	II. Ec.D.		4	32	I. Oc.R.		10	14	II. Tr.I.		21	52	I. Tr.I.
	12	10	II. Oc.R.		6	54	III. Tr.E.		10	31	II. Sh.E.		22	53	I. Sh.E.
	20	05	III. Sh.I.		22	27	I. Sh.I.		12	47	II. Tr.E.				
	22	44	III. Sh.E.		23	28	I. Tr.I.		21	40	I. Ec.D.	28	0	04	I. Tr.E.
	23	24	I. Ec.D.										4	45	II. Ec.D.
	23	50	III. Tr.I.	12	0	38	I. Sh.E.						9	40	II. Oc.R.
					1	40	I. Tr.E.	20	1	00	I. Oc.R.		18	02	I. Ec.D.
4	2	34	I. Oc.R.		5	26	II. Sh.I.		18	49	I. Sh.I.		21	26	I. Oc.R.
	2	36	III. Tr.E.		7	30	II. Tr.I.		19	55	I. Tr.I.		21	55	III. Ec.D.
	20	34	I. Sh.I.		7	56	II. Sh.E.		21	00	I. Sh.E.				
	21	30	I. Tr.I.		10	03	II. Tr.E.		22	07	I. Tr.E.				
	22	45	I. Sh.E.		19	46	I. Ec.D.					29	0	39	III. Ec.R.
	23	42	I. Tr.E.		23	02	I. Oc.R.		21	2	11		2	42	III. Oc.D.
									6	59	II. Oc.R.		5	33	III. Oc.R.
5	2	51	II. Sh.I.	13	16	56	I. Sh.I.		16	08	I. Ec.D.		15	11	I. Sh.I.
	4	45	II. Tr.I.		17	58	I. Tr.I.		17	57	III. Ec.D.		16	21	I. Tr.I.
	5	20	II. Sh.E.		19	07	I. Sh.E.		19	29	I. Oc.R.		17	22	I. Sh.E.
	7	18	II. Tr.E.		20	09	I. Tr.E.		20	40	III. Ec.R.		18	33	I. Tr.E.
	17	53	I. Ec.D.		23	38	II. Ec.D.		22	30	III. Oc.D.		23	55	II. Sh.I.
	21	03	I. Oc.R.												
				14	4	16	II. Oc.R.	22	1	20	III. Oc.R.				
6	15	02	I. Sh.I.		13	59	III. Ec.D.		13	18	I. Sh.I.				
	16	00	I. Tr.I.		14	14	I. Ec.D.		14	24	I. Tr.I.				
	17	13	I. Sh.E.		16	41	III. Ec.R.		15	28	I. Sh.E.				
	18	11	I. Tr.E.		17	31	I. Oc.R.		16	36	I. Tr.E.				
	21	04	II. Ec.D.		18	16	III. Oc.D.		21	20	II. Sh.I.				
					21	05	III. Oc.R.		23	36	II. Tr.I.				
									23	49	II. Sh.E.				
7	1	32	II. Oc.R.												
	10	01	III. Ec.D.	15	11	24	I. Sh.I.								
	12	21	I. Ec.D.		12	27	I. Tr.I.	23	2	09	II. Tr.E.				
	12	42	III. Ec.R.		13	35	I. Sh.E.		10	36	I. Ec.D.				
	13	58	III. Oc.D.		14	39	I. Tr.E.		13	58	I. Oc.R.				
	15	33	I. Oc.R.		18	44	II. Sh.I.								
	16	46	III. Oc.R.		20	53	II. Tr.I.	24	7	46	I. Sh.I.				
					21	14	II. Sh.E.		8	54	I. Tr.I.				
8	9	31	I. Sh.I.		23	25	II. Tr.E.		9	57	I. Sh.E.				
	10	29	I. Tr.I.						11	05	I. Tr.E.				
	11	42	I. Sh.E.	16	8	43	I. Ec.D.		15	28	II. Ec.D.				
	12	41	I. Tr.E.		12	01	I. Oc.R.		20	20	II. Oc.R.				
	16	09	II. Sh.I.												
	18	08	II. Tr.I.	17	5	52	I. Sh.I.	25	5	05	I. Ec.D.				
	18	38	II. Sh.E.		6	57	I. Tr.I.		7	58	III. Sh.I.				
I. Feb. 14				II. Feb. 13				III. Feb. 14				IV			
$x_1 = -1.9, y_1 = -0.3$				$x_1 = -2.3, y_1 = -0.4$				$x_1 = -3.1, y_1 = -0.6$ $x_2 = -1.6, y_2 = -0.6$				No eclipse			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR FEBRUARY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W</p> <p>• d</p> 	<p>III E W</p> <p>• • d r</p>  <p>E</p>
<p>II W</p> <p>• d</p> 	<p>IV E W</p> <p>No eclipse</p> <p>E</p>

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

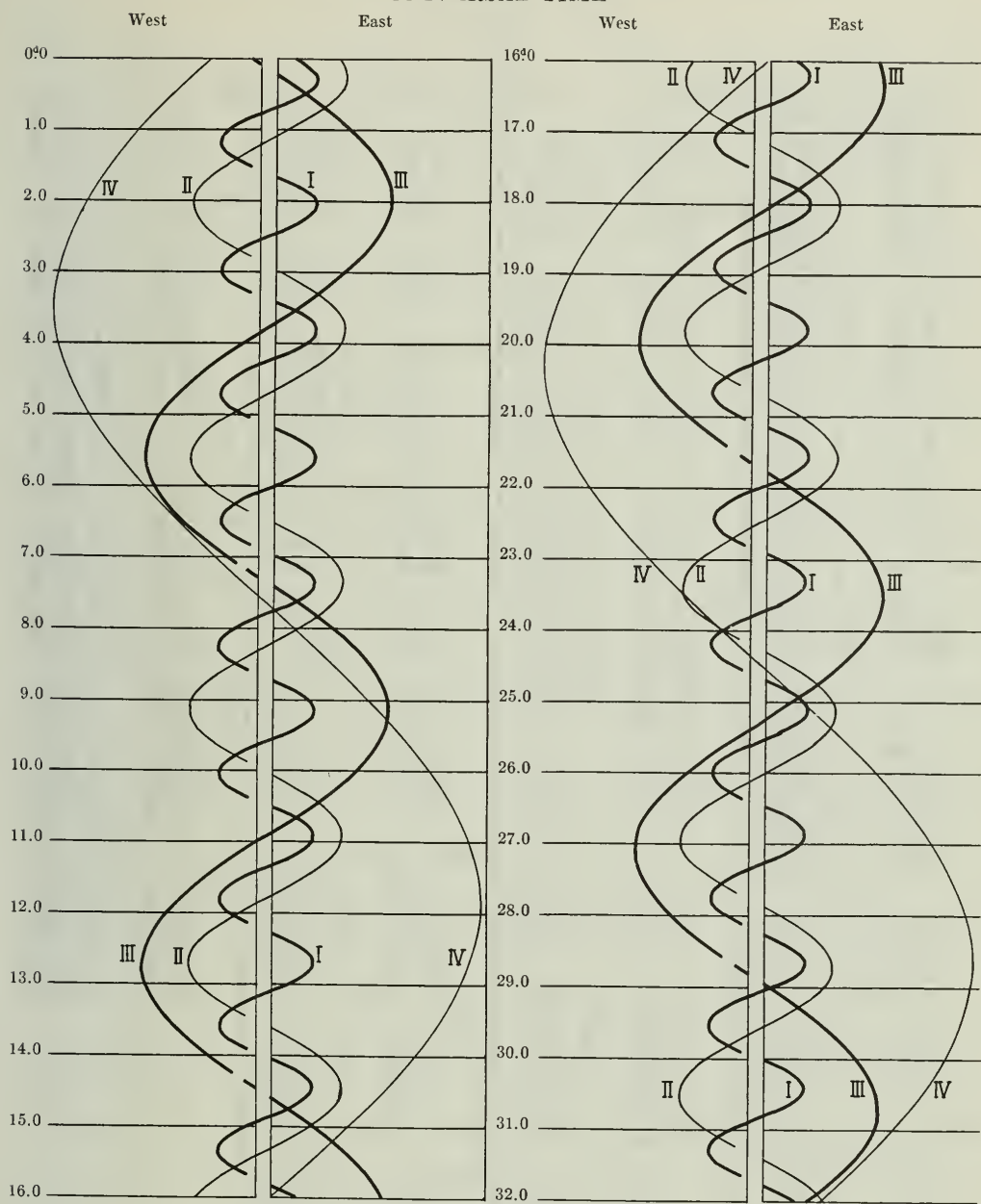
MARCH

d	h	m		d	h	m		d	h	m		d	h	m	
1	2	17	II. Tr.I.	9	12	46	I. Tr.I.	17	14	14	I. Oc.R.	25	2	33	III. Sh.E.
	2	24	II. Sh.E.		13	43	I. Sh.E.		19	51	III. Sh.I.		4	56	III. Tr.I.
	4	50	II. Tr.E.		14	57	I. Tr.E.		22	35	III. Sh.E.		7	46	III. Tr.E.
	12	30	I. Ec.D.		20	36	II. Ec.D.						9	47	I. Sh.I.
	15	55	I. Oc.R.						0	57	III. Tr.I.		11	03	I. Tr.I.
2	9	39	I. Sh.I.	10	1	40	II. Oc.R.	18	3	46	III. Tr.E.		11	58	I. Sh.E.
	10	50	I. Tr.I.		8	52	I. Ec.D.		7	54	I. Sh.I.		13	14	I. Tr.E.
	11	50	I. Sh.E.		12	20	I. Oc.R.		9	09	I. Tr.I.		20	56	II. Sh.I.
	13	02	I. Tr.E.		15	54	III. Sh.I.		10	05	I. Sh.E.		23	27	II. Sh.E.
	18	02	II. Ec.D.		18	37	III. Sh.E.		11	21	I. Tr.E.		23	27	II. Tr.I.
	23	01	II. Oc.R.		20	54	III. Tr.I.		18	21	II. Sh.I.				
					23	43	III. Tr.E.		20	52	II. Sh.E.	26	2	01	II. Tr.E.
3	6	58	I. Ec.D.	11	6	01	I. Sh.I.		20	52	II. Tr.I.		7	07	I. Ec.D.
	10	24	I. Oc.R.		7	14	I. Tr.I.		23	26	II. Tr.E.		10	36	I. Oc.R.
	11	55	III. Sh.I.		8	12	I. Sh.E.	19	5	13	I. Ec.D.	27	4	16	I. Sh.I.
	14	38	III. Sh.E.		9	26	I. Tr.E.		8	43	I. Oc.R.		5	31	I. Tr.I.
	16	46	III. Tr.I.		15	47	II. Sh.I.						6	27	I. Sh.E.
	19	35	III. Tr.E.		18	15	II. Tr.I.	20	2	22	I. Sh.I.		7	43	I. Tr.E.
4	4	07	I. Sh.I.		18	17	II. Sh.E.		3	37	I. Tr.I.		15	02	II. Ec.D.
	5	19	I. Tr.I.		20	49	II. Tr.E.		4	33	I. Sh.E.		17	34	II. Ec.R.
	6	18	I. Sh.E.	12	3	20	I. Ec.D.		5	49	I. Tr.E.		17	35	II. Oc.D.
	7	31	I. Tr.E.		6	48	I. Oc.R.		12	27	II. Ec.D.		20	11	II. Oc.R.
	13	12	II. Sh.I.						15	00	II. Ec.R.				
	15	37	II. Tr.I.	13	0	29	I. Sh.I.		15	00	II. Oc.D.	28	1	35	I. Ec.D.
	15	42	II. Sh.E.		1	43	I. Tr.I.		17	36	II. Oc.R.		5	04	I. Oc.R.
	18	10	II. Tr.E.		2	40	I. Sh.E.		23	42	I. Ec.D.		13	45	III. Ec.D.
5	1	27	I. Ec.D.		3	55	I. Tr.E.	21	3	11	I. Oc.R.		16	32	III. Ec.R.
	4	53	I. Oc.R.		9	53	II. Ec.D.		9	47	III. Ec.D.		18	54	III. Oc.D.
	22	36	I. Sh.I.		14	59	II. Oc.R.		12	34	III. Ec.R.		21	47	III. Oc.R.
	23	48	I. Tr.I.		21	48	I. Ec.D.		14	56	III. Oc.D.		22	44	I. Sh.I.
									17	49	III. Oc.R.		23	59	I. Tr.I.
6	0	46	I. Sh.E.	14	1	17	I. Oc.R.		20	50	I. Sh.I.	29	0	55	I. Sh.E.
	2	00	I. Tr.E.		5	50	III. Ec.D.		22	06	I. Tr.I.		2	11	I. Tr.E.
	7	19	II. Ec.D.		8	35	III. Ec.R.		23	02	I. Sh.E.		10	13	II. Sh.I.
	12	20	II. Oc.R.		10	55	III. Oc.D.	22	0	18	I. Tr.E.		12	43	II. Tr.I.
	19	55	I. Ec.D.		13	47	III. Oc.R.		7	39	II. Sh.I.		12	44	II. Sh.E.
	23	22	I. Oc.R.		18	57	I. Sh.I.		10	09	II. Sh.E.		15	17	II. Tr.E.
7	1	53	III. Ec.D.		20	12	I. Tr.I.		10	10	II. Tr.I.		20	03	I. Ec.D.
	4	37	III. Ec.R.		21	08	I. Sh.E.		12	44	II. Tr.E.		23	33	I. Oc.R.
	6	50	III. Oc.D.		22	24	I. Tr.E.		18	10	I. Ec.D.	30	17	12	I. Sh.I.
	9	42	III. Oc.R.	15	5	04	II. Sh.I.		21	40	I. Oc.R.		18	27	I. Tr.I.
	17	04	I. Sh.I.		7	34	II. Tr.I.	23	15	19	I. Sh.I.		19	23	I. Sh.E.
	18	17	I. Tr.I.		7	34	II. Sh.E.		16	34	I. Tr.I.		20	39	I. Tr.E.
	19	15	I. Sh.E.		10	08	II. Tr.E.		17	30	I. Sh.E.	31	4	19	II. Ec.D.
	20	28	I. Tr.E.		16	17	I. Ec.D.		18	46	I. Tr.E.		9	28	II. Oc.R.
8	2	29	II. Sh.I.		19	46	I. Oc.R.						14	32	I. Ec.D.
	4	57	II. Tr.I.	16	13	25	I. Sh.I.	24	1	44	II. Ec.D.		18	01	I. Oc.R.
	4	59	II. Sh.E.		14	40	I. Tr.I.		4	17	II. Ec.R.				
	7	30	II. Tr.E.		15	37	I. Sh.E.		4	18	II. Oc.D.				
	14	23	I. Ec.D.		16	52	I. Tr.E.		6	54	II. Oc.R.				
	17	51	I. Oc.R.		23	10	II. Ec.D.		12	38	I. Ec.D.				
9	11	32	I. Sh.I.	17	4	18	II. Oc.R.		16	08	I. Oc.R.				
					10	45	I. Ec.D.		23	49	III. Sh.I.				
I. Mar. 15				II. Mar. 20				III. Mar. 14				IV			
$x_1 = -2.0, y_1 = -0.2$				$x_1 = -2.6, y_1 = -0.4$ $x_2 = -0.9, y_2 = -0.4$				$x_1 = -3.5, y_1 = -0.6$ $x_2 = -2.0, y_2 = -0.6$				No eclipse			




NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR MARCH

UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W</p> <p>* d</p> 	<p>III W</p> <p>* * d r</p>  <p>E</p>
<p>II W</p> <p>* d</p> 	<p>IV W</p> <p>No eclipse</p> <p>E</p>

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

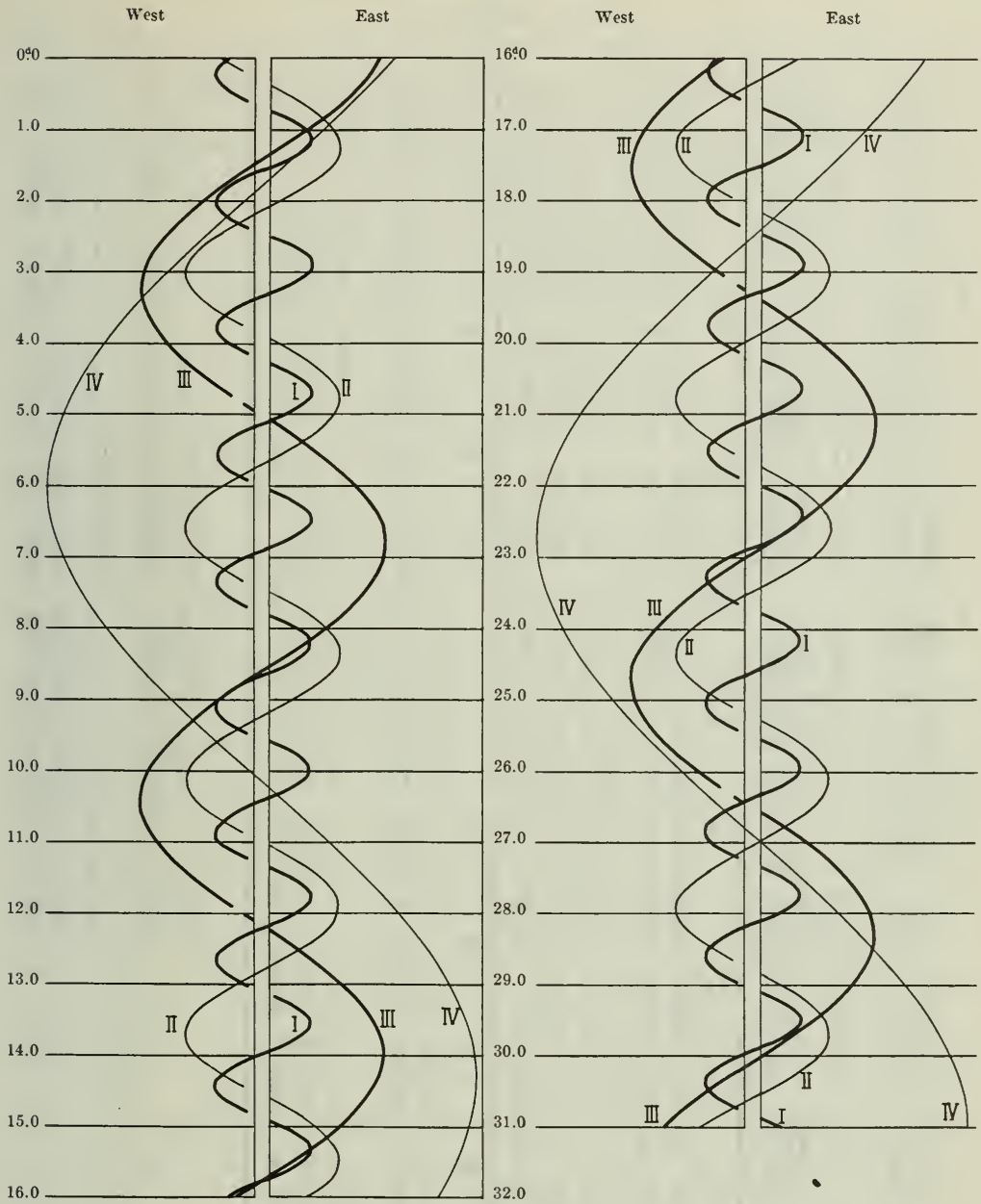
APRIL

d	h	m		d	h	m		d	h	m		d	h	m	
1	3	46	III. Sh.I.	8	16	59	I. Tr.E.	16	16	10	I. Oc.R.	25	1	21	II. Ec.D.
	6	32	III. Sh.E.										6	12	II. Oc.R.
	8	51	III. Tr.I.	9	2	04	II. Sh.I.	17	9	55	I. Sh.I.		9	08	I. Ec.D.
	11	40	I. Sh.I.		4	30	II. Tr.I.		11	05	I. Tr.I.		12	27	I. Oc.R.
	11	41	III. Tr.E.		4	35	II. Sh.E.		12	07	I. Sh.E.				
	12	55	I. Tr.I.		7	04	II. Tr.E.		13	17	I. Tr.E.	26	5	36	III. Ec.D.
	13	52	I. Sh.E.		10	53	I. Ec.D.		22	46	II. Ec.D.		6	17	I. Sh.I.
	15	07	I. Tr.E.		14	20	I. Oc.R.	18	3	45	II. Oc.R.		7	22	I. Tr.I.
	23	30	II. Sh.I.	10	8	02	I. Sh.I.		7	15	I. Ec.D.		8	27	III. Ec.R.
2	1	59	II. Tr.I.		9	15	I. Tr.I.		10	38	I. Oc.R.		8	29	I. Sh.E.
	2	01	II. Sh.E.		10	13	I. Sh.E.	19	1	39	III. Ec.D.		9	34	I. Tr.E.
	4	33	II. Tr.E.		11	27	I. Tr.E.		4	24	I. Sh.I.		10	00	III. Oc.D.
	9	00	I. Ec.D.		20	11	II. Ec.D.		4	29	III. Ec.R.		12	54	III. Oc.R.
	12	29	I. Oc.R.	11	1	16	II. Oc.R.		5	33	I. Tr.I.		20	29	II. Sh.I.
3	6	09	I. Sh.I.		5	21	I. Ec.D.		6	21	III. Oc.D.		22	36	II. Tr.I.
	7	23	I. Tr.I.		8	48	I. Oc.R.		6	35	I. Sh.E.	27	1	10	II. Tr.E.
	8	20	I. Sh.E.		21	41	III. Ec.D.		7	45	I. Tr.E.		3	36	I. Ec.D.
	9	35	I. Tr.E.						9	14	III. Oc.R.		6	54	I. Oc.R.
	17	36	II. Ec.D.	12	0	30	III. Ec.R.		17	55	II. Sh.I.				
	22	44	II. Oc.R.		2	30	I. Sh.I.		20	11	II. Tr.I.	28	0	45	I. Sh.I.
4	3	28	I. Ec.D.		2	36	III. Oc.D.		20	27	II. Sh.E.		1	49	I. Tr.I.
	6	57	I. Oc.R.		3	43	I. Tr.I.		22	45	II. Tr.E.		2	58	I. Sh.E.
	17	43	III. Ec.D.		4	42	I. Sh.E.	20	1	43	I. Ec.D.		4	02	I. Tr.E.
	20	32	III. Ec.R.		5	30	III. Oc.R.		5	05	I. Oc.R.		14	38	II. Ec.D.
	22	47	III. Oc.D.		5	55	I. Tr.E.		22	52	I. Sh.I.		19	24	II. Oc.R.
5	0	37	I. Sh.I.		15	21	II. Sh.I.						22	05	I. Ec.D.
	1	41	III. Oc.R.		17	44	II. Tr.I.	21	0	00	I. Tr.I.	29	1	21	I. Oc.R.
	1	51	I. Tr.I.		17	53	II. Sh.E.		1	04	I. Sh.E.		19	14	I. Sh.I.
	2	48	I. Sh.E.		20	18	II. Tr.E.		2	12	I. Tr.E.		19	37	III. Sh.I.
	4	03	I. Tr.E.		23	50	I. Ec.D.		12	03	II. Ec.D.		20	16	I. Tr.I.
	12	47	II. Sh.I.	13	3	15	I. Oc.R.		16	58	II. Oc.R.		21	26	I. Sh.E.
	15	15	II. Tr.I.		20	59	I. Sh.I.		20	11	I. Ec.D.		22	27	III. Sh.E.
	15	18	II. Sh.E.		22	10	I. Tr.I.		23	32	I. Oc.R.		22	29	I. Tr.E.
	17	49	II. Tr.E.		23	10	I. Sh.E.						23	49	III. Tr.I.
	21	57	I. Ec.D.	14	0	22	I. Tr.E.	22	15	39	III. Sh.I.	30	2	42	III. Tr.E.
6	1	25	I. Oc.R.		9	28	II. Ec.D.		17	20	I. Sh.I.		9	45	II. Sh.I.
	19	05	I. Sh.I.		14	30	II. Oc.R.		18	27	I. Tr.I.		11	47	II. Tr.I.
	20	19	I. Tr.I.		18	18	I. Ec.D.		18	28	III. Sh.E.		12	18	II. Sh.E.
	21	17	I. Sh.E.		21	43	I. Oc.R.		19	32	I. Sh.E.		14	22	II. Tr.E.
	22	31	I. Tr.E.						20	11	III. Tr.I.		16	33	I. Ec.D.
7	6	53	II. Ec.D.	15	11	41	III. Sh.I.		20	40	I. Tr.E.		19	48	I. Oc.R.
	12	00	II. Oc.R.		14	29	III. Sh.E.		23	03	III. Tr.E.				
	16	25	I. Ec.D.		15	27	I. Sh.I.	23	7	12	II. Sh.I.				
	19	52	I. Oc.R.		16	28	III. Tr.I.		9	24	II. Tr.I.				
8	7	43	III. Sh.I.		16	38	I. Tr.I.		9	44	II. Sh.E.				
	10	32	III. Sh.E.		17	39	I. Sh.E.		11	58	II. Tr.E.				
	12	40	III. Tr.I.		18	50	I. Tr.E.		14	40	I. Ec.D.				
	13	34	I. Sh.I.		19	20	III. Tr.E.		17	59	I. Oc.R.				
	14	47	I. Tr.I.	16	4	38	II. Sh.I.	24	11	49	I. Sh.I.				
	15	33	III. Tr.E.		6	58	II. Tr.I.		12	55	I. Tr.I.				
	15	45	I. Sh.E.		7	10	II. Sh.E.		14	01	I. Sh.E.				
					9	32	II. Tr.E.		15	07	I. Tr.E.				
					12	46	I. Ec.D.								
I. Apr. 16				II. Apr. 14				III. Apr. 19				IV			
$x_1 = -2.0, y_1 = -0.2$				$x_1 = -2.5, y_1 = -0.4$				$x_1 = -3.3, y_1 = -0.6$ $x_2 = -1.8, y_2 = -0.6$				No eclipse			




NOTE.—I. de notes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR APRIL

UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W • </p> <p>d</p>	<p>III E • •  E</p> <p>d r</p>
<p>II W • </p> <p>d</p>	<p>IV E W No eclipse E</p>

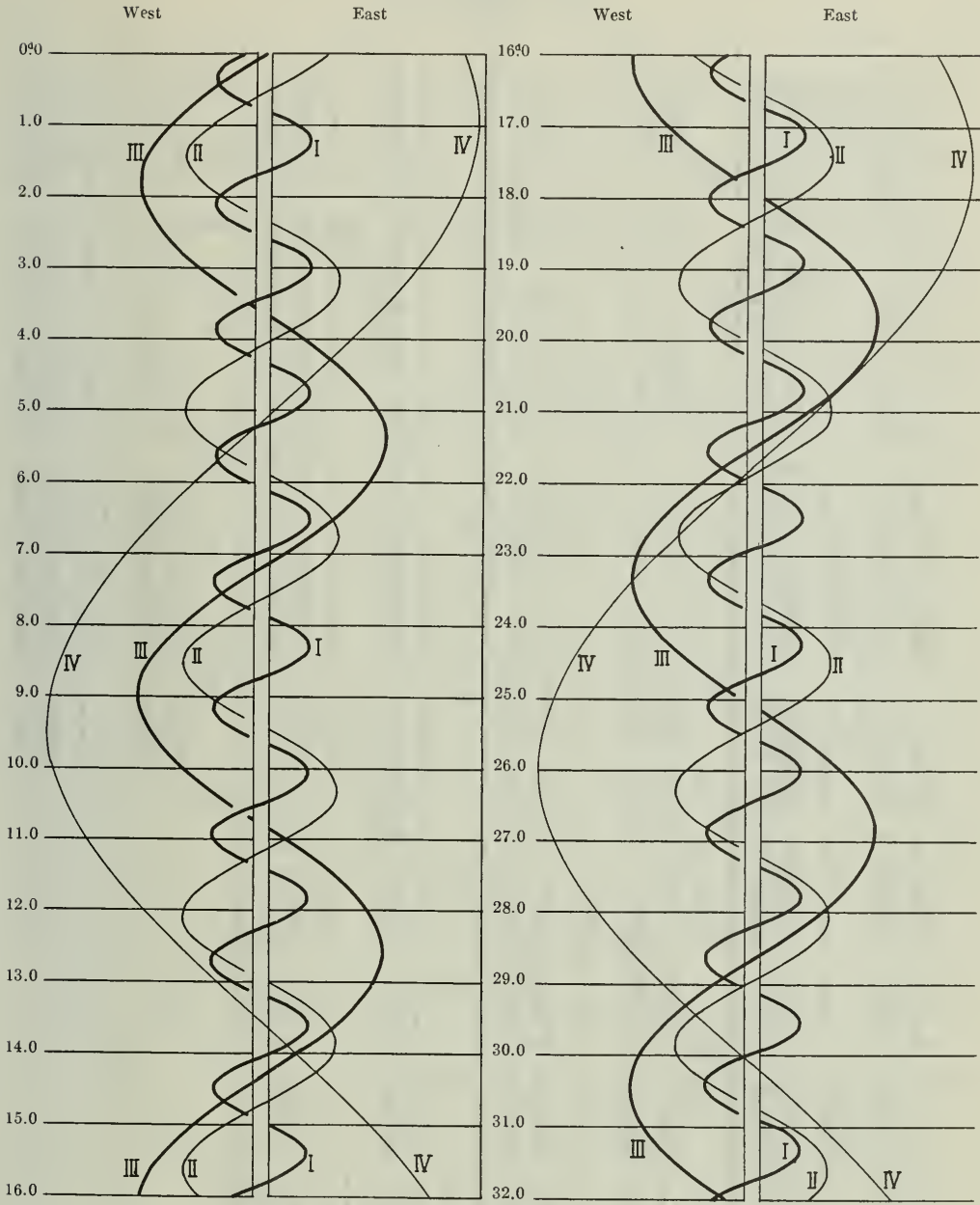
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

MAY




d	h	m		d	h	m		d	h	m		d	h	m	
1	13	42	I. Sh.I.	9	12	55	I. Ec.D.	17	17	29	III. Ec.D.	25	11	10	I. Ec.D.
	14	43	I. Tr.I.		16	01	I. Oc.R.		20	23	III. Ec.R.		13	58	I. Oc.R.
	15	54	I. Sh.E.						20	33	III. Oc.D.				
	16	56	I. Tr.E.	10	10	04	I. Sh.I.		23	27	III. Oc.R.	26	8	20	I. Sh.I.
					10	57	I. Tr.I.						8	55	I. Tr.I.
2	3	56	II. Ec.D.		12	17	I. Sh.E.	18	4	10	II. Sh.I.		10	33	I. Sh.E.
	8	36	II. Oc.R.		13	10	I. Tr.E.		5	37	II. Tr.I.		11	08	I. Tr.E.
	11	01	I. Ec.D.		13	32	III. Ec.D.		6	43	II. Sh.E.				
	14	15	I. Oc.R.		16	24	III. Ec.R.		8	12	II. Tr.E.	27	1	01	II. Ec.D.
					17	06	III. Oc.D.		9	16	I. Ec.D.		4	48	II. Oc.R.
3	8	10	I. Sh.I.		20	00	III. Oc.R.		12	14	I. Oc.R.		5	38	I. Ec.D.
	9	10	I. Tr.I.										8	25	I. Oc.R.
	9	34	III. Ec.D.	11	1	36	II. Sh.I.	19	6	26	I. Sh.I.				
	10	23	I. Sh.E.		3	19	II. Tr.I.		7	10	I. Tr.I.	28	2	49	I. Sh.I.
	11	23	I. Tr.E.		4	09	II. Sh.E.		8	39	I. Sh.E.		3	21	I. Tr.I.
	12	26	III. Ec.R.		5	53	II. Tr.E.		9	23	I. Tr.E.		5	02	I. Sh.E.
	13	35	III. Oc.D.		7	23	I. Ec.D.		22	25	II. Ec.D.		5	34	I. Tr.E.
	16	29	III. Oc.R.		10	28	I. Oc.R.						11	28	III. Sh.I.
	23	02	II. Sh.I.					20	2	29	II. Oc.R.		13	38	III. Tr.I.
4	0	58	II. Tr.I.	12	4	32	I. Sh.I.		3	45	I. Ec.D.		14	22	III. Sh.E.
	1	35	II. Sh.E.		5	24	I. Tr.I.		6	40	I. Oc.R.		16	31	III. Tr.E.
	3	33	II. Tr.E.		6	45	I. Sh.E.	21	0	55	I. Sh.I.		20	00	II. Sh.I.
	5	30	I. Ec.D.		7	37	I. Tr.E.		1	36	I. Tr.I.		21	02	II. Tr.I.
	8	41	I. Oc.R.		19	49	II. Ec.D.		3	08	I. Sh.E.		22	34	II. Sh.E.
									3	49	I. Tr.E.		23	37	II. Tr.E.
5	2	39	I. Sh.I.	13	0	10	II. Oc.R.		7	30	III. Sh.I.	29	0	07	I. Ec.D.
	3	37	I. Tr.I.		1	51	I. Ec.D.		10	16	III. Tr.I.		2	51	I. Oc.R.
	4	51	I. Sh.E.		4	54	I. Oc.R.		10	24	III. Sh.E.		21	17	I. Sh.I.
	5	49	I. Tr.E.		23	01	I. Sh.I.		13	09	III. Tr.E.		21	47	I. Tr.I.
	17	14	II. Ec.D.		23	50	I. Tr.I.		17	26	II. Sh.I.		23	30	I. Sh.E.
	21	48	II. Oc.R.	14	1	14	I. Sh.E.		18	46	II. Tr.I.				
	23	58	I. Ec.D.		2	03	I. Tr.E.		20	00	II. Sh.E.	30	0	01	I. Tr.E.
					3	33	III. Sh.I.		21	21	II. Tr.E.		14	20	II. Ec.D.
6	3	08	I. Oc.R.		6	25	III. Sh.E.		22	13	I. Ec.D.		17	57	II. Oc.R.
	21	07	I. Sh.I.		6	51	III. Tr.I.						18	35	I. Ec.D.
	22	04	I. Tr.I.		9	44	III. Tr.E.	22	1	06	I. Oc.R.		21	17	I. Oc.R.
	23	20	I. Sh.E.		14	53	II. Sh.I.		19	23	I. Sh.I.				
	23	35	III. Sh.I.		16	28	II. Tr.I.		20	02	I. Tr.I.	31	15	46	I. Sh.I.
					17	26	II. Sh.E.		21	36	I. Sh.E.		16	14	I. Tr.I.
7	0	16	I. Tr.E.		19	03	II. Tr.E.		22	16	I. Tr.E.		17	59	I. Sh.E.
	2	26	III. Sh.E.		20	20	I. Ec.D.						18	27	I. Tr.E.
	3	22	III. Tr.I.		23	21	I. Oc.R.								
	6	15	III. Tr.E.					23	11	44	II. Ec.D.				
	12	19	II. Sh.I.	15	17	29	I. Sh.I.		15	39	II. Oc.R.				
	14	09	II. Tr.I.		18	17	I. Tr.I.		16	42	I. Ec.D.				
	14	52	II. Sh.E.		19	42	I. Sh.E.		19	32	I. Oc.R.				
	16	43	II. Tr.E.		20	30	I. Tr.E.					24	13	52	I. Sh.I.
	18	26	I. Ec.D.										14	29	I. Tr.I.
	21	35	I. Oc.R.	16	9	08	II. Ec.D.						16	05	I. Sh.E.
					13	20	II. Oc.R.						16	42	I. Tr.E.
8	15	36	I. Sh.I.		14	48	I. Ec.D.						21	28	III. Ec.D.
	16	30	I. Tr.I.		17	47	I. Oc.R.								
	17	48	I. Sh.E.					25	2	51	III. Oc.R.				
	18	43	I. Tr.E.						6	43	II. Sh.I.				
				17	11	58	I. Sh.I.			7	54	II. Tr.I.			
9	6	32	II. Ec.D.		12	43	I. Tr.I.			9	17	II. Sh.E.			
	10	59	II. Oc.R.		14	11	I. Sh.E.			10	29	II. Tr.E.			
					14	56	I. Tr.E.								
I. May 16				II. May 16				III. May 17				IV			
$x_1 = -1.6, y_1 = -0.2$				$x_1 = -2.0, y_1 = -0.4$				$x_1 = -2.5, y_1 = -0.6$ $x_2 = -0.9, y_2 = -0.6$				No eclipse			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR MAY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W</p> <p>* d</p> 	<p>III W</p> <p>* d</p>  <p>E</p>
<p>II W</p> <p>* d</p> 	<p>IV W</p> <p>No eclipse</p> <p>E</p>

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

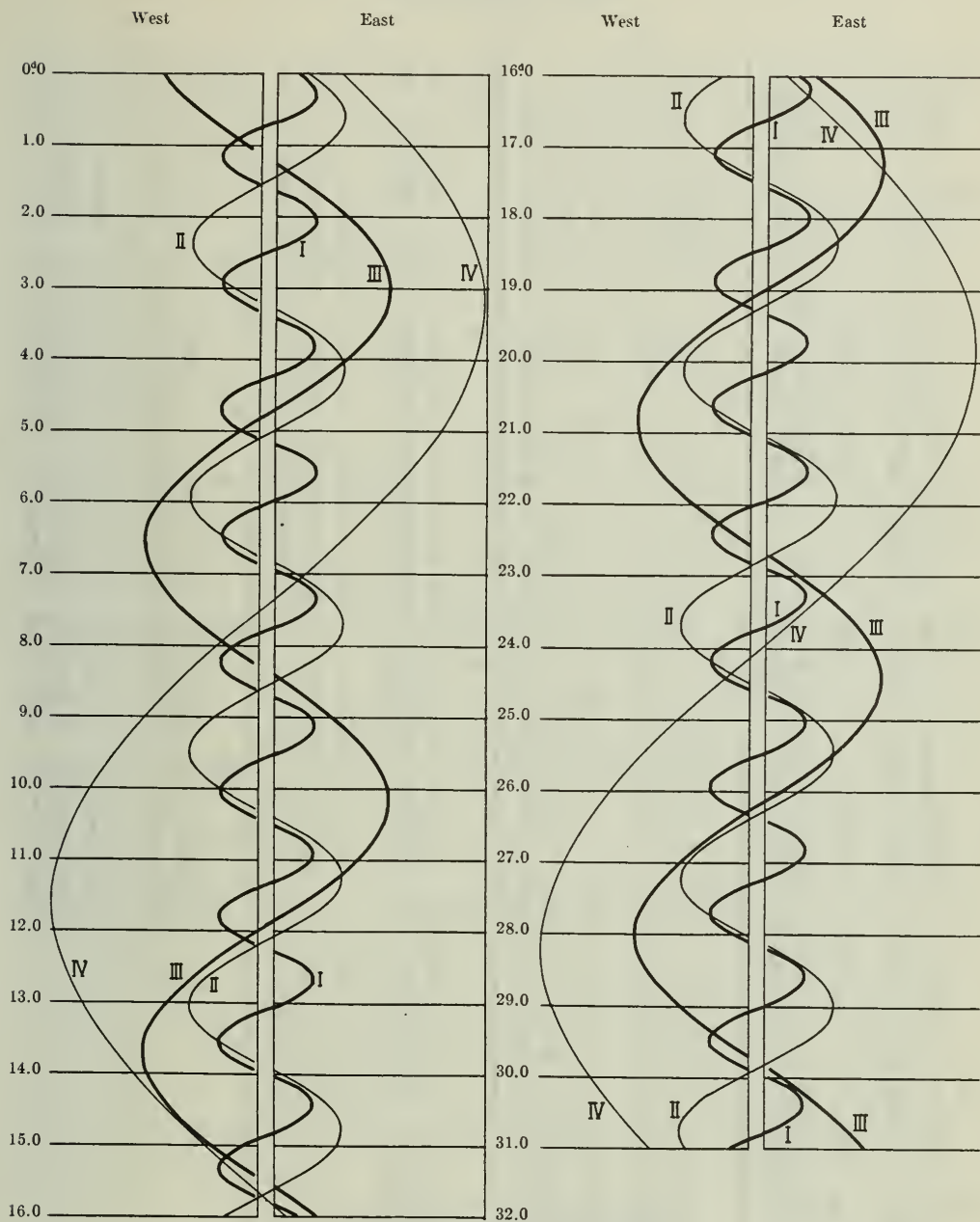
JUNE

d	h	m		d	h	m		d	h	m		d	h	m	
1	1	26	III. Ec.D.	9	12	08	I. Sh.I.	18	8	31	I. Sh.I.	26	6	15	II. Sh.I.
	6	12	III. Oc.R.		12	24	I. Tr.I.		8	34	I. Tr.I.		6	22	III. Sh.E.
	9	17	II. Sh.I.		14	22	I. Sh.E.		10	45	I. Sh.E.		7	33	I. Oc.D.
	10	09	II. Tr.I.		14	37	I. Tr.E.		10	47	I. Tr.E.		8	32	II. Tr.E.
	11	51	II. Sh.E.						23	27	III. Sh.I.		8	51	II. Sh.E.
	12	44	II. Tr.E.	10	6	14	II. Ec.D.		23	33	III. Tr.I.		9	55	I. Ec.R.
	13	04	I. Ec.D.		9	21	II. Oc.R.								
	15	43	I. Oc.R.		9	26	I. Ec.D.	19	2	22	III. Sh.E.	27	4	44	I. Tr.I.
					11	53	I. Oc.R.		2	27	III. Tr.E.		4	55	I. Sh.I.
2	10	14	I. Sh.I.						3	41	II. Sh.I.		6	58	I. Tr.E.
	10	40	I. Tr.I.	11	6	37	I. Sh.I.		3	44	II. Tr.I.		7	08	I. Sh.E.
	12	28	I. Sh.E.		6	50	I. Tr.I.		5	48	I. Ec.D.				
	12	53	I. Tr.E.		8	51	I. Sh.E.		6	17	II. Sh.E.	28	0	24	II. Oc.D.
					9	03	I. Tr.E.		6	19	II. Tr.E.		1	59	I. Oc.D.
3	3	38	II. Ec.D.		19	29	III. Sh.I.		8	02	I. Oc.R.		3	26	II. Ec.R.
	7	05	II. Oc.R.		20	16	III. Tr.I.						4	24	I. Ec.R.
	7	32	I. Ec.D.		22	22	III. Sh.E.	20	3	00	I. Tr.I.		23	10	I. Tr.I.
	10	09	I. Oc.R.		23	09	III. Tr.E.		3	00	I. Sh.I.		23	23	I. Sh.I.
									5	13	I. Tr.E.				
4	4	43	I. Sh.I.	12	1	07	II. Sh.I.		5	14	I. Sh.E.	29	1	24	I. Tr.E.
	5	06	I. Tr.I.		1	31	II. Tr.I.		22	08	II. Oc.D.		1	37	I. Sh.E.
	6	56	I. Sh.E.		3	43	II. Sh.E.						16	24	III. Oc.D.
	7	19	I. Tr.E.		3	54	I. Ec.D.	21	0	15	I. Oc.D.		19	05	II. Tr.I.
	15	27	III. Sh.I.		4	05	II. Tr.E.		0	48	II. Ec.R.		19	32	II. Sh.I.
	16	58	III. Tr.I.		6	18	I. Oc.R.		2	29	I. Ec.R.		20	19	III. Ec.R.
	18	22	III. Sh.E.						21	26	I. Tr.I.		20	25	I. Oc.D.
	19	51	III. Tr.E.	13	1	05	I. Sh.I.		21	29	I. Sh.I.		21	39	II. Tr.E.
	22	33	II. Sh.I.		1	16	I. Tr.I.		23	40	I. Tr.E.		22	08	II. Sh.E.
	23	17	II. Tr.I.		3	19	I. Sh.E.		23	43	I. Sh.E.		22	52	I. Ec.R.
					3	29	I. Tr.E.								
5	1	08	II. Sh.E.		19	33	II. Ec.D.	22	13	08	III. Oc.D.	30	17	36	I. Tr.I.
	1	51	II. Tr.E.		22	23	I. Ec.D.		16	19	III. Ec.R.		17	52	I. Sh.I.
	2	00	I. Ec.D.		22	29	II. Oc.R.		16	51	II. Tr.I.		19	50	I. Tr.E.
	4	35	I. Oc.R.						16	58	II. Sh.I.		20	06	I. Sh.E.
	23	11	I. Sh.I.	14	0	44	I. Oc.R.		18	41	I. Oc.D.				
	23	32	I. Tr.I.		19	34	I. Sh.I.		19	25	II. Tr.E.				
					19	42	I. Tr.I.		19	34	II. Sh.E.				
6	1	25	I. Sh.E.		21	48	I. Sh.E.		20	58	I. Ec.R.				
	1	45	I. Tr.E.		21	55	I. Tr.E.								
	16	56	II. Ec.D.					23	15	52	I. Tr.I.				
	20	13	II. Oc.R.	15	9	23	III. Ec.D.		15	57	I. Sh.I.				
	20	29	I. Ec.D.		12	46	III. Oc.R.		18	06	I. Tr.E.				
	23	01	I. Oc.R.		14	24	II. Sh.I.		18	11	I. Sh.E.				
					14	37	II. Tr.I.								
7	17	40	I. Sh.I.		16	51	I. Ec.D.	24	11	15	II. Oc.D.				
	17	58	I. Tr.I.		17	00	II. Sh.E.		13	07	I. Oc.D.				
	19	53	I. Sh.E.		17	12	II. Tr.E.		14	06	II. Ec.R.				
	20	11	I. Tr.E.		19	10	I. Oc.R.		15	26	I. Ec.R.				
8	5	25	III. Ec.D.	16	14	03	I. Sh.I.	25	10	18	I. Tr.I.				
	9	30	III. Oc.R.		14	08	I. Tr.I.		10	26	I. Sh.I.				
	11	50	II. Sh.I.		16	16	I. Sh.E.		12	32	I. Tr.E.				
	12	24	II. Tr.I.		16	21	I. Tr.E.		12	40	I. Sh.E.				
	14	26	II. Sh.E.												
	14	57	I. Ec.D.												
	14	58	II. Tr.E.	17	8	51	II. Ec.D.	26	2	50	III. Tr.I.				
	17	27	I. Oc.R.		11	19	I. Ec.D.		3	24	III. Sh.I.				
					11	37	II. Oc.R.		5	43	III. Tr.E.				
					13	36	I. Oc.R.		5	58	II. Tr.I.				
I. June 15				II. June 17				III. June 15				IV			
$x_1 = -1.1, y_1 = -0.2$				$x_1 = -1.0, y_1 = -0.4$				$x_1 = -1.1, y_1 = -0.6$				No eclipse			




NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JUNE

UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		III	
W		E	
II		IV	
W		E	No eclipse

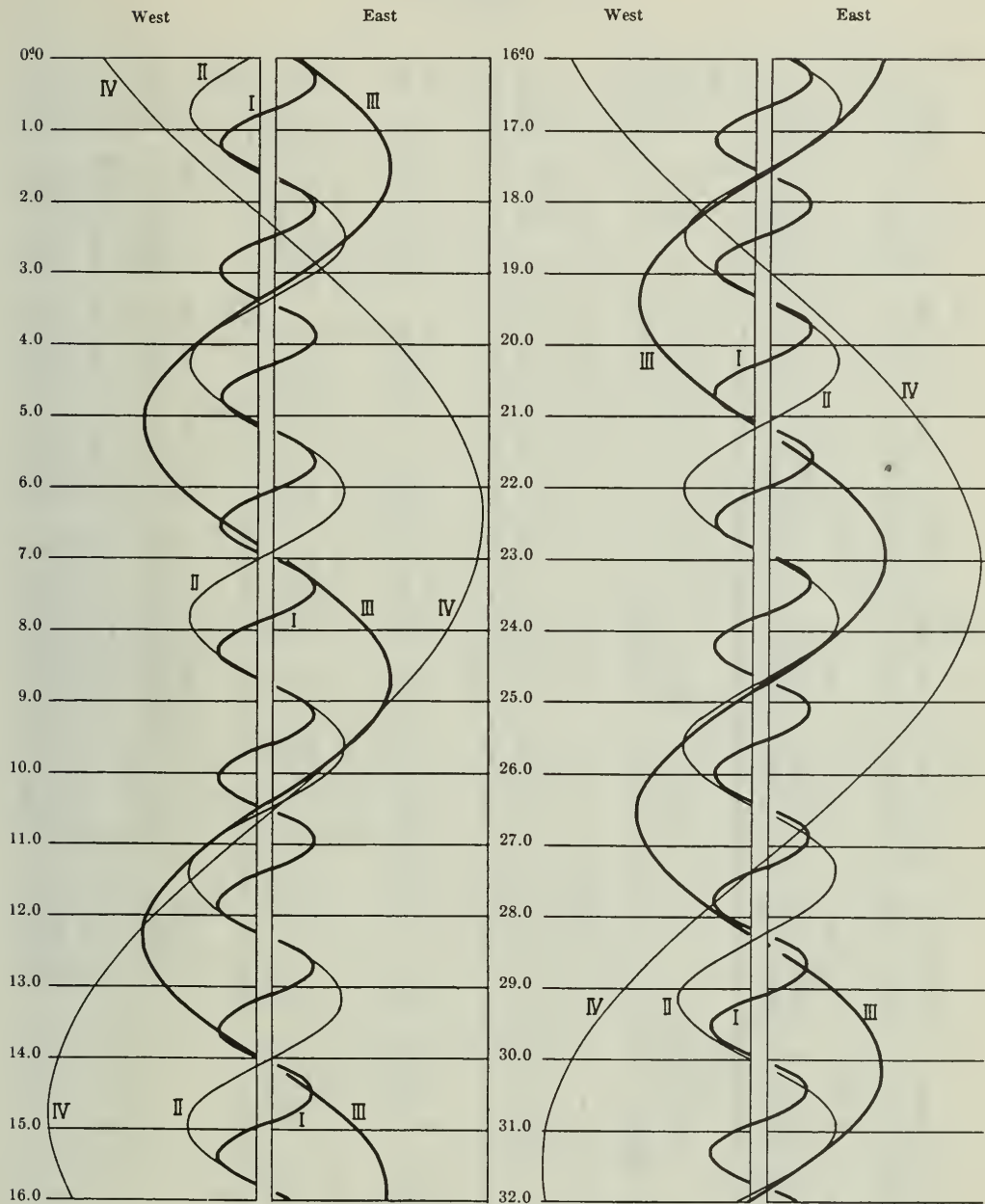
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

JULY


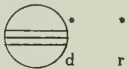

d	h	m		d	h	m		d	h	m		d	h	m	
1	13	31	II. Oc.D.	10	9	26	III. Tr.I.	17	18	21	III. Sh.E.	26	12	01	I. Ec.R.
	14	51	I. Oc.D.		10	27	II. Tr.I.						13	57	II. Ec.R.
	16	44	II. Ec.R.		11	01	I. Oc.D.	18	10	00	I. Tr.I.	27	6	13	I. Tr.I.
	17	21	I. Ec.R.		11	22	III. Sh.I.		10	39	I. Sh.I.		7	03	I. Sh.I.
2	12	03	I. Tr.I.		11	23	II. Sh.I.		12	13	I. Tr.E.		8	27	I. Tr.E.
	12	21	I. Sh.I.		12	20	III. Tr.E.		12	53	I. Sh.E.		9	17	I. Sh.E.
	14	16	I. Tr.E.		13	01	II. Tr.E.	19	7	13	I. Oc.D.	28	3	26	I. Oc.D.
	14	35	I. Sh.E.		13	43	I. Ec.R.		7	16	II. Oc.D.		4	10	II. Tr.I.
					14	00	II. Sh.E.		10	07	I. Ec.R.		5	49	II. Sh.I.
					14	21	III. Sh.E.		11	19	II. Ec.R.		5	52	III. Oc.D.
3	6	07	III. Tr.I.	11	8	14	I. Tr.I.	20	4	26	I. Tr.I.	29	0	40	I. Tr.I.
	7	24	III. Sh.I.		8	44	I. Sh.I.		5	08	I. Sh.I.		1	32	I. Sh.I.
	8	12	II. Tr.I.		10	27	I. Tr.E.		6	40	I. Tr.E.		2	53	I. Tr.E.
	8	49	II. Sh.I.		10	58	I. Sh.E.		7	22	I. Sh.E.		3	46	I. Sh.E.
	9	01	III. Tr.E.										8	26	II. Sh.E.
	9	17	I. Oc.D.										8	49	III. Oc.R.
	10	22	III. Sh.E.	12	4	57	II. Oc.D.	21	1	39	I. Oc.D.		9	17	III. Ec.D.
	10	46	II. Tr.E.		5	27	I. Oc.D.		1	52	II. Tr.I.		12	19	III. Ec.R.
	11	26	II. Sh.E.		8	12	I. Ec.R.		2	25	III. Oc.D.	29			
	11	49	I. Ec.R.		8	41	II. Ec.R.		3	15	II. Sh.I.				
4	6	29	I. Tr.I.	13	2	40	I. Tr.I.		4	26	II. Tr.E.				
	6	49	I. Sh.I.		3	13	I. Sh.I.		4	35	I. Ec.R.				
	8	42	I. Tr.E.		4	54	I. Tr.E.		5	52	II. Sh.E.				
	9	03	I. Sh.E.		5	27	I. Sh.E.		8	19	III. Ec.R.				
					23	02	III. Oc.D.		22	53	I. Tr.I.	30	0	58	I. Ec.R.
5	2	40	II. Oc.D.		23	35	II. Tr.I.		23	37	I. Sh.I.		3	15	II. Ec.R.
	3	43	I. Oc.D.		23	54	I. Oc.D.	22	1	06	I. Tr.E.		19	07	I. Tr.I.
	6	03	II. Ec.R.						1	51	I. Sh.E.		20	01	I. Sh.I.
	6	18	I. Ec.R.	14	0	40	II. Sh.I.		20	06	I. Oc.D.		21	20	I. Tr.E.
6	0	55	I. Tr.I.		2	09	II. Tr.E.		20	26	II. Oc.D.		22	15	I. Sh.E.
	1	18	I. Sh.I.		2	41	I. Ec.R.		23	04	I. Ec.R.	31	16	19	I. Oc.D.
	3	08	I. Tr.E.		3	17	II. Sh.E.						17	20	II. Tr.I.
	3	32	I. Sh.E.		4	19	III. Ec.R.	23	0	37	II. Ec.R.		17	20	II. Tr.I.
	19	42	III. Oc.D.		21	07	I. Tr.I.		17	20	I. Tr.I.		19	07	II. Sh.I.
	21	19	II. Tr.I.		21	42	I. Sh.I.		18	06	I. Sh.I.		19	27	I. Ec.R.
	22	06	II. Sh.I.		23	20	I. Tr.E.		19	33	I. Tr.E.		19	42	III. Tr.I.
	22	09	I. Oc.D.		23	56	I. Sh.E.		20	19	I. Sh.E.		19	55	II. Tr.E.
	23	53	II. Tr.E.										21	44	II. Sh.E.
7	0	18	III. Ec.R.	15	18	06	II. Oc.D.	24	14	32	I. Oc.D.		22	37	III. Tr.E.
	0	43	II. Sh.E.		18	20	I. Oc.D.		15	01	II. Tr.I.		23	21	III. Sh.I.
	0	46	I. Ec.R.		21	09	I. Ec.R.		16	13	III. Tr.I.				
	19	21	I. Tr.I.		21	59	II. Ec.R.		16	32	II. Sh.I.				
	19	47	I. Sh.I.	16	15	33	I. Tr.I.		17	32	I. Ec.R.				
	21	35	I. Tr.E.		16	11	I. Sh.I.		17	35	II. Tr.E.				
	22	01	I. Sh.E.		17	47	I. Tr.E.		19	08	III. Tr.E.				
8	15	48	II. Oc.D.		18	24	I. Sh.E.		19	09	II. Sh.E.				
	16	35	I. Oc.D.	17	12	43	II. Tr.I.		19	21	III. Sh.I.				
	19	15	I. Ec.R.		12	46	I. Oc.D.		22	22	III. Sh.E.				
	19	22	II. Ec.R.		12	47	III. Tr.I.	25	11	46	I. Tr.I.				
9	13	47	I. Tr.I.		13	58	II. Sh.I.		12	34	I. Sh.I.				
	14	16	I. Sh.I.		15	17	II. Tr.E.		14	00	I. Tr.E.				
	16	01	I. Tr.E.		15	21	III. Sh.I.		14	48	I. Sh.E.				
	16	30	I. Sh.E.		15	38	I. Ec.R.	26	8	59	I. Oc.D.				
					15	42	III. Tr.E.		9	37	II. Oc.D.				
					16	34	II. Sh.E.								
I. July 15				II. July 15				III. July 28				IV			
$x_2 = +1.5, y_2 = -0.2$				$x_2 = +1.7, y_2 = -0.4$				$x_1 = +1.1, y_1 = -0.6$ $x_2 = +2.7, y_2 = -0.6$				No eclipse			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JULY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		III	
W		E	
II		IV	
W		E	No eclipse

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

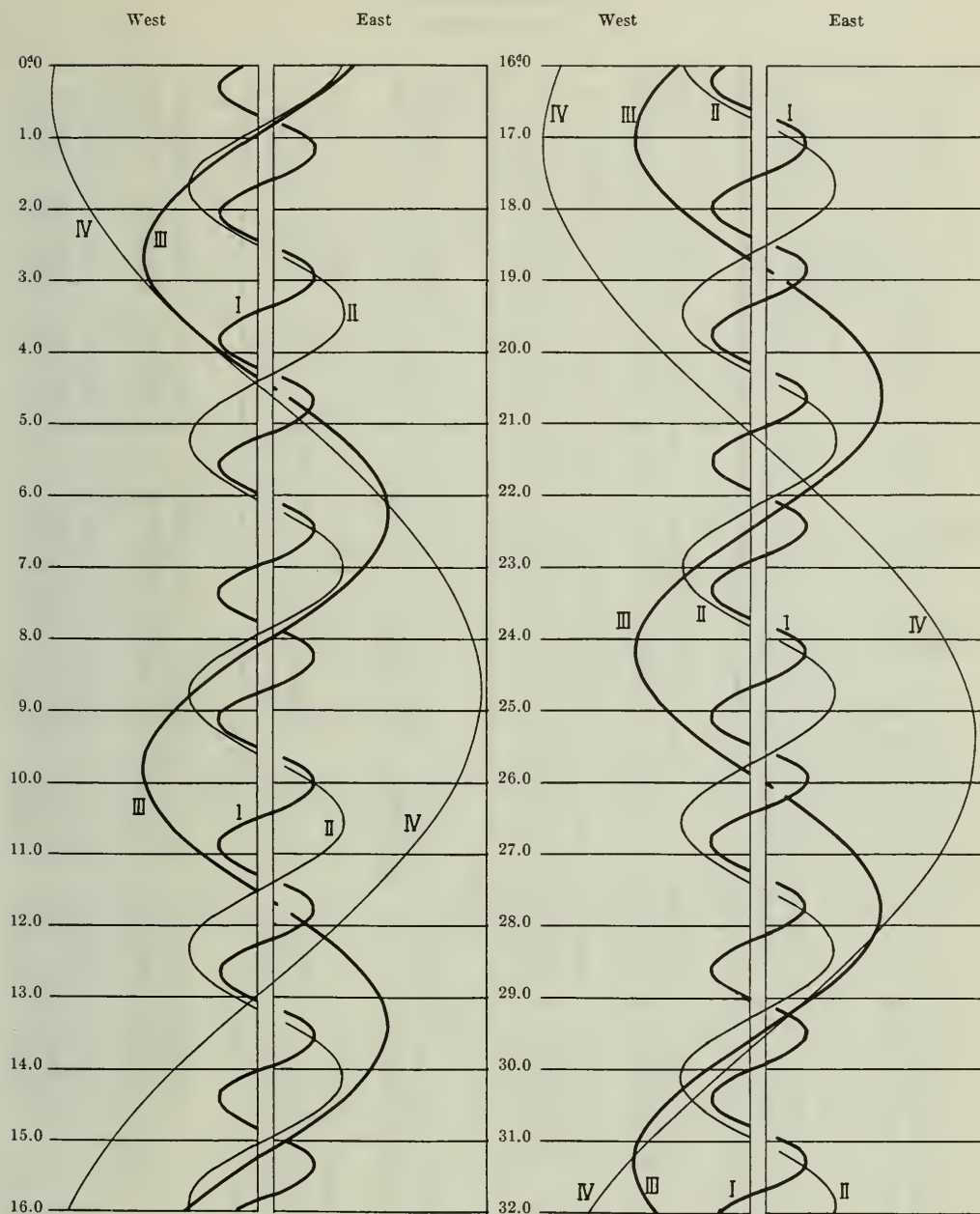
AUGUST

d	h	m		d	h	m		d	h	m		d	h	m		
1	2	22	III. Sh.E.	9	14	24	II. Oc.D.	17	15	03	I. Sh.E.	25	18	47	II. Sh.E.	
	13	34	I. Tr.I.		15	50	I. Ec.R.						20	19	III. Oc.D.	
	14	30	I. Sh.I.		19	13	II. Ec.R.	18	8	52	I. Oc.D.		23	19	III. Oc.R.	
	15	47	I. Tr.E.						11	19	II. Tr.I.					
	16	43	I. Sh.E.	10	9	51	I. Tr.I.		12	14	I. Ec.R.	26	1	14	III. Ec.D.	
2	10	46	I. Oc.D.		10	54	I. Sh.I.		13	34	II. Sh.I.		4	20	III. Ec.R.	
	11	59	II. Oc.D.		12	04	I. Tr.E.		13	54	II. Tr.E.		8	00	I. Tr.I.	
	13	56	I. Ec.R.		13	07	I. Sh.E.		16	11	II. Sh.E.		9	13	I. Sh.I.	
	16	35	II. Ec.R.	11	7	02	I. Oc.D.		16	35	III. Oc.D.		10	13	I. Tr.E.	
					8	54	II. Tr.I.		19	35	III. Oc.R.		11	27	I. Sh.E.	
					10	19	I. Ec.R.		21	14	III. Ec.D.					
3	8	01	I. Tr.I.		10	59	II. Sh.I.	19	0	20	III. Ec.R.	27	5	10	I. Oc.D.	
	8	58	I. Sh.I.		11	29	II. Tr.E.		6	09	I. Tr.I.		8	35	II. Oc.D.	
	10	15	I. Tr.E.		12	56	III. Oc.D.		7	18	I. Sh.I.		8	38	I. Ec.R.	
	11	12	I. Sh.E.		13	36	II. Sh.E.		8	22	I. Tr.E.		13	47	II. Ec.R.	
					15	55	III. Oc.R.		9	31	I. Sh.E.	28	2	29	I. Tr.I.	
4	5	13	I. Oc.D.		17	15	III. Ec.D.						3	42	I. Sh.I.	
	6	31	II. Tr.I.		20	19	III. Ec.R.	20	3	19	I. Oc.D.		4	41	I. Tr.E.	
	8	24	II. Sh.I.						6	05	II. Oc.D.		5	56	I. Sh.E.	
	8	24	I. Ec.R.						6	43	I. Ec.R.		23	38	I. Oc.D.	
	9	06	II. Tr.E.	12	4	18	I. Tr.I.		11	09	II. Ec.R.					
	9	22	III. Oc.D.		5	22	I. Sh.I.					29	3	01	II. Tr.I.	
	11	01	II. Sh.E.		6	31	I. Tr.E.						3	06	I. Ec.R.	
	12	20	III. Oc.R.		7	36	I. Sh.E.	21	0	37	I. Tr.I.			5	26	II. Sh.I.
	13	16	III. Ec.D.						1	47	I. Sh.I.			5	36	II. Tr.E.
	16	19	III. Ec.R.	13	1	29	I. Oc.D.		2	50	I. Tr.E.			8	05	II. Sh.E.
					3	37	II. Oc.D.		4	00	I. Sh.E.		10	21	III. Tr.I.	
5	2	29	I. Tr.I.		4	48	I. Ec.R.		21	47	I. Oc.D.		13	19	III. Tr.E.	
	3	27	I. Sh.I.		8	31	II. Ec.R.						15	20	III. Sh.I.	
	4	42	I. Tr.E.		22	46	I. Tr.I.	22	0	33	II. Tr.I.		18	24	III. Sh.E.	
	5	41	I. Sh.E.		23	51	I. Sh.I.		1	11	I. Ec.R.		20	57	I. Tr.I.	
	23	40	I. Oc.D.						2	51	II. Sh.I.		22	11	I. Sh.I.	
				14	0	59	I. Tr.E.		3	07	II. Tr.E.		23	10	I. Tr.E.	
6	1	11	II. Oc.D.		2	05	I. Sh.E.		5	29	II. Sh.E.					
	2	53	I. Ec.R.		19	57	I. Oc.D.		6	35	III. Tr.I.					
	5	53	II. Ec.R.		22	06	II. Tr.I.		9	32	III. Tr.E.	30	0	24	I. Sh.E.	
	20	56	I. Tr.I.		23	17	I. Ec.R.		11	21	III. Sh.I.		18	06	I. Oc.D.	
	21	56	I. Sh.I.						14	24	III. Sh.E.		21	35	I. Ec.R.	
	23	09	I. Tr.E.	15	0	16	II. Sh.I.		19	04	I. Tr.I.		21	52	II. Oc.D.	
					0	41	II. Tr.E.		20	16	I. Sh.I.					
7	0	10	I. Sh.E.		2	53	III. Tr.I.		21	17	I. Tr.E.	31	3	06	II. Ec.R.	
	18	07	I. Oc.D.		2	54	II. Sh.E.		22	29	I. Sh.E.		15	25	I. Tr.I.	
	19	42	II. Tr.I.		5	50	III. Tr.E.						16	40	I. Sh.I.	
	21	22	I. Ec.R.		7	21	III. Sh.I.	23	16	15	I. Oc.D.		17	38	I. Tr.E.	
	21	41	II. Sh.I.		10	24	III. Sh.E.		19	20	II. Oc.D.		18	53	I. Sh.E.	
	22	17	II. Tr.E.		17	13	I. Tr.I.		19	40	I. Ec.R.					
	23	15	III. Tr.I.		18	20	I. Sh.I.									
					19	26	I. Tr.E.	24	0	28	II. Ec.R.					
8	0	19	II. Sh.E.		20	34	I. Sh.E.		13	32	I. Tr.I.					
	2	12	III. Tr.E.						14	44	I. Sh.I.					
	3	21	III. Sh.I.	16	14	24	I. Oc.D.		15	45	I. Tr.E.					
	6	23	III. Sh.E.		16	51	II. Oc.D.		16	58	I. Sh.E.					
	15	23	I. Tr.I.		17	45	I. Ec.R.									
	16	25	I. Sh.I.		21	51	II. Ec.R.	25	10	42	I. Oc.D.					
	17	36	I. Tr.E.						13	47	II. Tr.I.					
	18	39	I. Sh.E.	17	11	41	I. Tr.I.		14	09	I. Ec.R.					
					12	49	I. Sh.I.		16	09	II. Sh.I.					
9	12	35	I. Oc.D.		13	54	I. Tr.E.		16	22	II. Tr.E.					
I. Aug. 16				II. Aug. 16				III. Aug. 18-19				IV				
$x_2=+1.9, y_2=-0.2$				$x_2=+2.5, y_2=-0.4$				$x_1=+1.7, y_1=-0.5$ $x_2=+3.4, y_2=-0.5$				No eclipse				



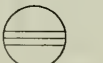
NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR AUGUST

UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W</p>  <p>E</p>	<p>III W</p>  <p>E</p>
<p>II W</p>  <p>E</p>	<p>IV W</p> <p>No eclipse</p> <p>E</p>

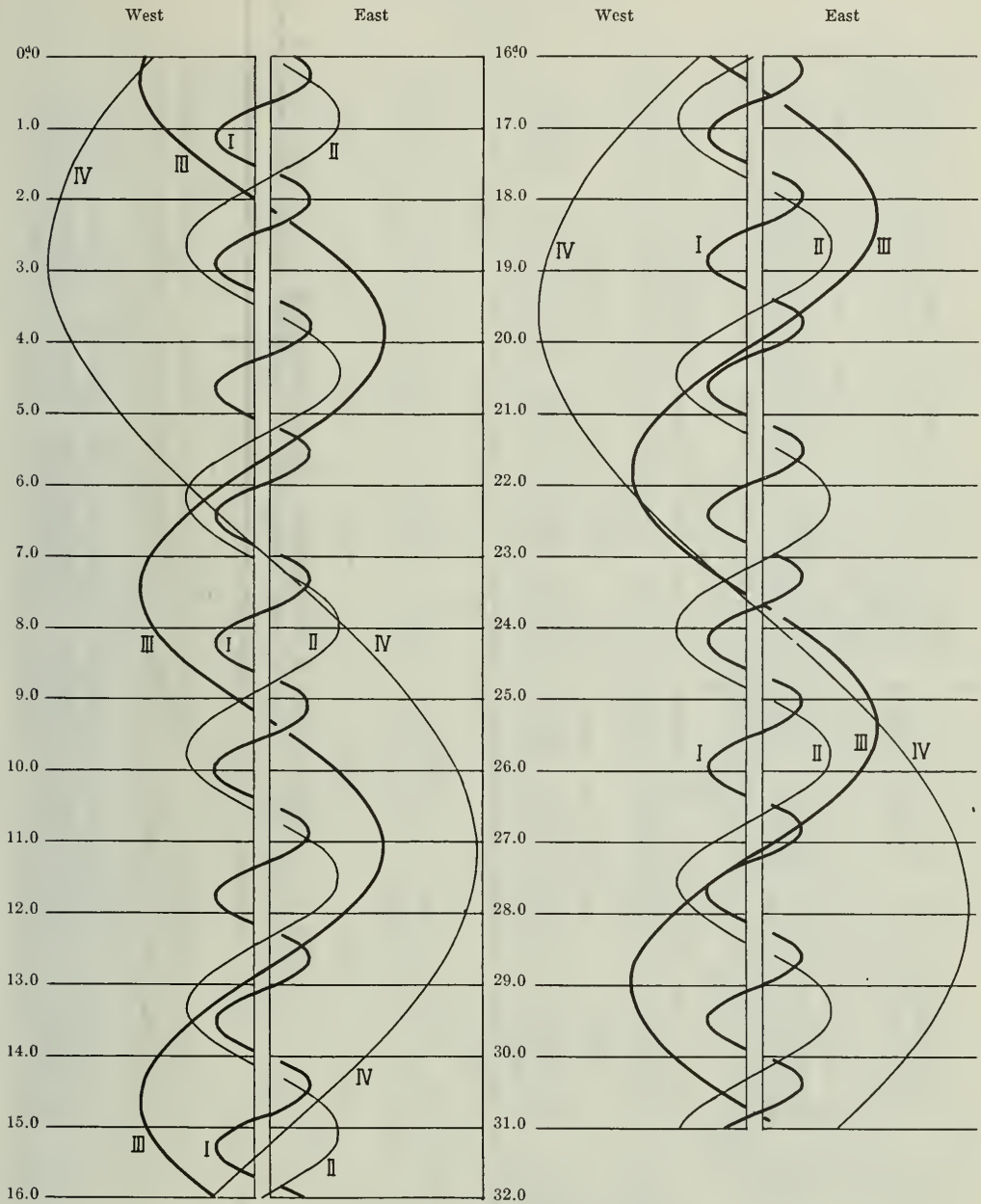
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

SEPTEMBER

d	h	m		d	h	m		d	h	m		d	h	m	
1	12	35	I. Oc.D.	8	23	58	II. Sh.E.	16	13	42	I. Tr.I.	24	5	02	IV. Ec.R.
	16	04	I. Ec.R.						15	00	I. Sh.I.		12	46	I. Oc.D.
	16	16	II. Tr.I.	9	4	01	III. Oc.D.		15	55	I. Tr.E.		16	18	I. Ec.R.
	18	44	II. Sh.I.		7	03	III. Oc.R.		16	22	III. Ec.R.		18	58	II. Oc.D.
	18	51	II. Tr.E.		9	14	III. Ec.D.		17	13	I. Sh.E.				
	21	22	II. Sh.E.		11	47	I. Tr.I.					25	0	18	II. Ec.R.
					12	22	III. Ec.R.	17	10	51	I. Oc.D.		10	07	I. Tr.I.
2	0	08	III. Oc.D.		13	04	I. Sh.I.		14	23	I. Ec.R.		11	24	I. Sh.I.
	3	09	III. Oc.R.		14	00	I. Tr.E.		16	20	II. Oc.D.		12	20	I. Tr.E.
	5	14	III. Ec.D.		15	18	I. Sh.E.		21	40	II. Ec.R.		13	37	I. Sh.E.
	8	21	III. Ec.R.												
	9	53	I. Tr.I.	10	8	56	I. Oc.D.	18	8	11	I. Tr.I.	26	7	15	I. Oc.D.
	11	09	I. Sh.I.		12	28	I. Ec.R.		9	28	I. Sh.I.		10	47	I. Ec.R.
	12	06	I. Tr.E.		13	43	II. Oc.D.		10	24	I. Tr.E.		13	17	II. Tr.I.
	13	22	I. Sh.E.		19	03	II. Ec.R.		11	42	I. Sh.E.		15	48	II. Sh.I.
													15	53	II. Tr.E.
3	7	03	I. Oc.D.	11	6	16	I. Tr.I.	19	5	19	I. Oc.D.		18	28	II. Sh.E.
	10	33	I. Ec.R.		7	33	I. Sh.I.		8	52	I. Ec.R.				
	11	08	II. Oc.D.		8	29	I. Tr.E.		10	40	II. Tr.I.	27	2	11	III. Tr.I.
	16	25	II. Ec.R.		9	47	I. Sh.E.		13	12	II. Sh.I.		4	36	I. Tr.I.
									13	16	II. Tr.E.		5	13	III. Tr.E.
4	4	22	I. Tr.I.	12	3	25	I. Oc.D.		15	52	II. Sh.E.		5	53	I. Sh.I.
	5	38	I. Sh.I.		6	57	I. Ec.R.		22	07	III. Tr.I.		6	49	I. Tr.E.
	6	35	I. Tr.E.		8	05	II. Tr.I.						7	21	III. Sh.I.
	7	51	I. Sh.E.		10	37	II. Sh.I.	20	1	08	III. Tr.E.		8	06	I. Sh.E.
					10	41	II. Tr.E.		2	40	I. Tr.I.		10	28	III. Sh.E.
5	1	31	I. Oc.D.		13	16	II. Sh.E.		3	20	III. Sh.I.				
	5	01	I. Ec.R.		18	07	III. Tr.I.		3	57	I. Sh.I.	28	1	44	I. Oc.D.
	5	32	II. Tr.I.		21	07	III. Tr.E.		4	53	I. Tr.E.		5	16	I. Ec.R.
	8	01	II. Sh.I.		23	20	III. Sh.I.		6	11	I. Sh.E.		8	19	II. Oc.D.
	8	07	II. Tr.E.						6	27	III. Sh.E.		13	37	II. Ec.R.
	10	40	II. Sh.E.	13	0	44	I. Tr.I.		23	48	I. Oc.D.		23	05	I. Tr.I.
	14	12	III. Tr.I.		2	02	I. Sh.I.								
	17	11	III. Tr.E.		2	26	III. Sh.E.	21	3	20	I. Ec.R.	29	0	22	I. Sh.I.
	19	20	III. Sh.I.		2	57	I. Tr.E.		5	39	II. Oc.D.		1	19	I. Tr.E.
	22	25	III. Sh.E.		4	15	I. Sh.E.		11	00	II. Ec.R.		2	35	I. Sh.E.
	22	50	I. Tr.I.		21	53	I. Oc.D.		21	09	I. Tr.I.		20	13	I. Oc.D.
									22	26	I. Sh.I.		23	44	I. Ec.R.
6	0	06	I. Sh.I.	14	1	25	I. Ec.R.		23	22	I. Tr.E.				
	1	03	I. Tr.E.		3	01	II. Oc.D.					30	2	36	II. Tr.I.
	2	20	I. Sh.E.		8	22	II. Ec.R.	22	0	40	I. Sh.E.		5	06	II. Sh.I.
	19	59	I. Oc.D.		19	13	I. Tr.I.		18	17	I. Oc.D.		5	13	II. Tr.E.
	23	30	I. Ec.R.		20	31	I. Sh.I.		21	49	I. Ec.R.		7	46	II. Sh.E.
					21	26	I. Tr.E.		23	58	II. Tr.I.		16	05	III. Oc.D.
7	0	26	II. Oc.D.		22	44	I. Sh.E.						17	35	I. Tr.I.
	5	44	II. Ec.R.					23	2	30	II. Sh.I.		18	50	I. Sh.I.
	9	52	IV. Ec.D.	15	16	22	I. Oc.D.		2	34	II. Tr.E.		19	09	III. Oc.R.
	10	41	IV. Ec.R.		17	31	IV. Sh.I.		5	10	II. Sh.E.		19	48	I. Tr.E.
	17	19	I. Tr.I.		18	12	IV. Sh.E.		12	00	III. Oc.D.		21	04	I. Sh.E.
	18	35	I. Sh.I.		19	54	I. Ec.R.		15	03	III. Oc.R.		21	13	III. Ec.D.
	19	32	I. Tr.E.		21	22	II. Tr.I.		15	38	I. Tr.I.				
	20	49	I. Sh.E.		23	55	II. Sh.I.		16	55	I. Sh.I.				
					23	58	II. Tr.E.		17	13	III. Ec.D.				
8	14	28	I. Oc.D.						17	51	I. Tr.E.				
	17	59	I. Ec.R.	16	2	34	II. Sh.E.		19	09	I. Sh.E.				
	18	48	II. Tr.I.		7	58	III. Oc.D.		20	23	III. Ec.R.				
	21	19	II. Sh.I.		11	01	III. Oc.R.								
	21	24	II. Tr.E.		13	14	III. Ec.D.	24	3	43	IV. Ec.D.				
I. Sept. 15				II. Sept. 14				III. Sept. 16				IV. Sept. 24			
$x_2 = +2.1, y_2 = -0.2$				$x_2 = +2.7, y_2 = -0.4$				$x_1 = +2.0, y_1 = -0.5$ $x_2 = +3.7, y_2 = -0.5$				$x_1 = +4.8, y_1 = -1.0$ $x_2 = +5.3, y_2 = -1.0$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR SEPTEMBER
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I				III			
W		*		E		* d	* r
II				IV			
W		*		E		** d	r
							E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

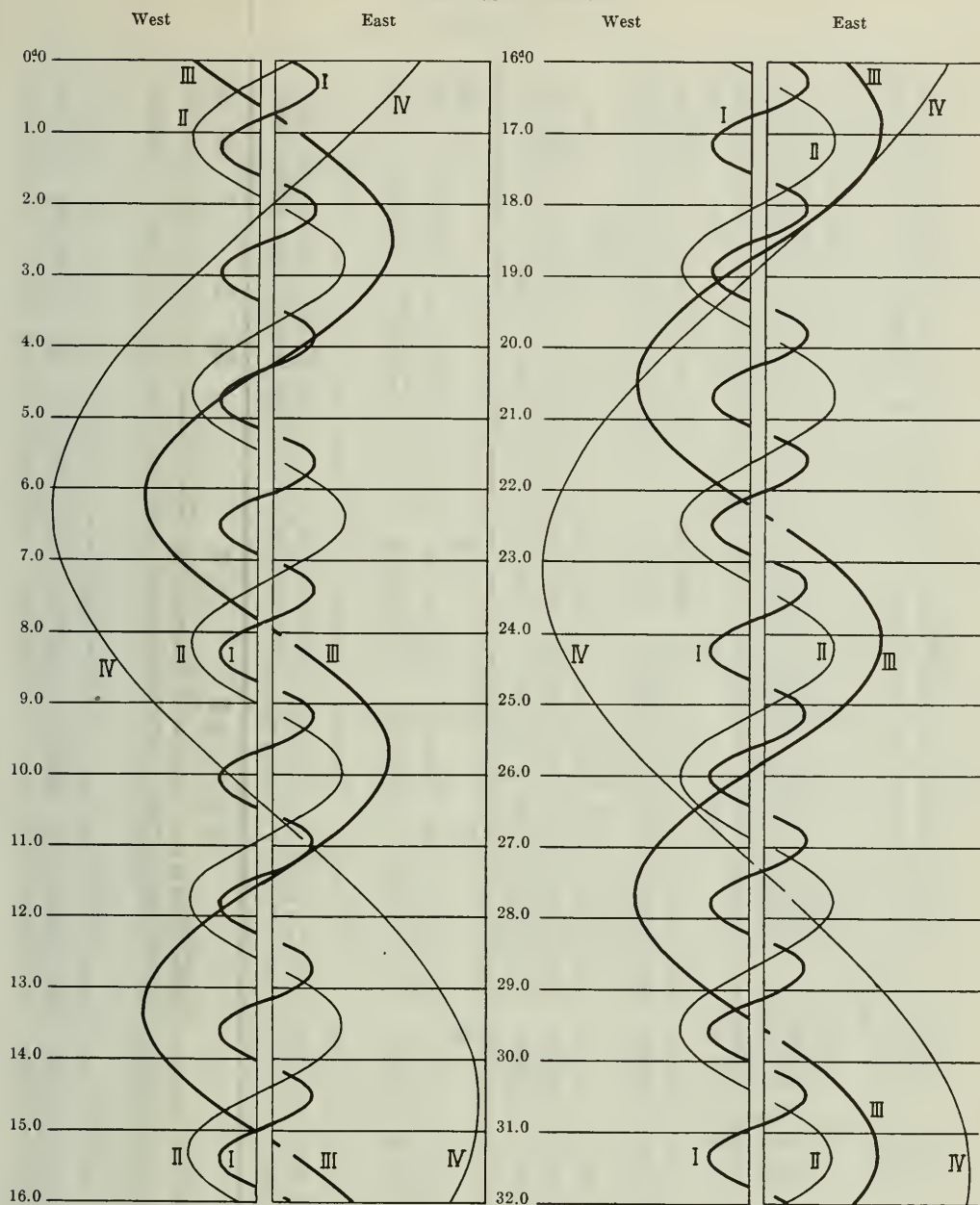
OCTOBER

d	h	m		d	h	m		d	h	m		d	h	m	
1	0	23	III. Ec.R.	9	5	33	II. Ec.R.	17	13	08	I. Oc.D.	25	0	02	II. Tr.I.
	14	43	I. Oc.D.		14	02	I. Tr.I.		16	32	I. Ec.R.		2	12	II. Sh.I.
	18	13	I. Ec.R.		15	15	I. Sh.I.		21	18	II. Tr.I.		2	42	II. Tr.E.
	21	39	II. Oc.D.		16	15	I. Tr.E.		23	36	II. Sh.I.		4	54	II. Sh.E.
					17	28	I. Sh.E.		23	57	II. Tr.E.		12	29	I. Tr.I.
2	2	55	II. Ec.R.										13	34	I. Sh.I.
	11	20	IV. Sh.I.	10	11	09	I. Oc.D.	18	2	18	II. Sh.E.		14	43	I. Tr.E.
	12	04	I. Tr.I.		14	37	I. Ec.R.		10	30	I. Tr.I.		15	48	I. Sh.E.
	12	37	IV. Sh.E.		18	36	II. Tr.I.		11	39	I. Sh.I.		18	58	III. Tr.I.
	13	19	I. Sh.I.		21	00	II. Sh.I.		12	43	I. Tr.E.		22	04	III. Tr.E.
	14	17	I. Tr.E.		21	14	II. Tr.E.		13	52	I. Sh.E.		23	20	III. Sh.I.
	15	33	I. Sh.E.		21	37	IV. Ec.D.		14	42	III. Tr.I.				
					23	19	IV. Ec.R.		17	47	III. Tr.E.	26	2	30	III. Sh.E.
3	9	12	I. Oc.D.		23	41	II. Sh.E.		18	21	IV. Tr.I.		9	36	I. Oc.D.
	12	42	I. Ec.R.						18	37	IV. Tr.E.		12	56	I. Ec.R.
	15	56	II. Tr.I.	11	8	31	I. Tr.I.		19	20	III. Sh.I.		19	11	II. Oc.D.
	18	24	II. Sh.I.		9	43	I. Sh.I.		22	30	III. Sh.E.				
	18	33	II. Tr.E.		10	29	III. Tr.I.					27	0	05	II. Ec.R.
	21	04	II. Sh.E.		10	45	I. Tr.E.	19	5	16	IV. Sh.I.		5	56	IV. Oc.D.
					11	57	I. Sh.E.		6	57	IV. Sh.E.		6	58	IV. Oc.R.
4	6	18	III. Tr.I.		13	33	III. Tr.E.		7	37	I. Oc.D.		6	59	I. Tr.I.
	6	33	I. Tr.I.		15	20	III. Sh.I.		11	01	I. Ec.R.		8	03	I. Sh.I.
	7	48	I. Sh.I.		18	30	III. Sh.E.		16	26	II. Oc.D.		9	13	I. Tr.E.
	8	46	I. Tr.E.						21	28	II. Ec.R.		10	17	I. Sh.E.
	9	20	III. Tr.E.	12	5	39	I. Oc.D.						15	33	IV. Ec.D.
	10	02	I. Sh.E.		9	06	I. Ec.R.	20	5	00	I. Tr.I.		17	34	IV. Ec.R.
	11	21	III. Sh.I.		13	42	II. Oc.D.		6	07	I. Sh.I.				
	14	29	III. Sh.E.		18	51	II. Ec.R.		7	13	I. Tr.E.	28	4	06	I. Oc.D.
									8	21	I. Sh.E.		7	25	I. Ec.R.
5	3	41	I. Oc.D.	13	3	01	I. Tr.I.						13	24	II. Tr.I.
	7	11	I. Ec.R.		4	12	I. Sh.I.	21	2	07	I. Oc.D.		15	30	II. Sh.I.
	11	00	II. Oc.D.		5	14	I. Tr.E.		5	30	I. Ec.R.		16	05	II. Tr.E.
	16	14	II. Ec.R.		6	26	I. Sh.E.		10	40	II. Tr.I.		18	13	II. Sh.E.
									12	54	II. Sh.I.				
6	1	03	I. Tr.I.	14	0	08	I. Oc.D.		13	19	II. Tr.E.	29	1	29	I. Tr.I.
	2	17	I. Sh.I.		3	35	I. Ec.R.		15	36	II. Sh.E.		2	31	I. Sh.I.
	3	16	I. Tr.E.		7	57	II. Tr.I.		23	29	I. Tr.I.		3	42	I. Tr.E.
	4	31	I. Sh.E.		10	18	II. Sh.I.						4	45	I. Sh.E.
	22	11	I. Oc.D.		10	35	II. Tr.E.	22	0	36	I. Sh.I.		8	59	III. Oc.D.
					12	59	II. Sh.E.		1	43	I. Tr.E.		12	08	III. Oc.R.
7	1	40	I. Ec.R.		21	30	I. Tr.I.		2	50	I. Sh.E.		13	13	III. Ec.D.
	5	16	II. Tr.I.		22	41	I. Sh.I.		4	41	III. Oc.D.		16	27	III. Ec.R.
	7	42	II. Sh.I.		23	44	I. Tr.E.		7	49	III. Oc.R.		22	36	I. Oc.D.
	7	53	II. Tr.E.						9	13	III. Ec.D.				
	10	23	II. Sh.E.	15	0	25	III. Oc.D.		12	26	III. Ec.R.	30	1	54	I. Ec.R.
	19	32	I. Tr.I.		0	55	I. Sh.E.		20	37	I. Oc.D.		8	34	II. Oc.D.
	20	13	III. Oc.D.		3	32	III. Oc.R.		23	59	I. Ec.R.		13	23	II. Ec.R.
	20	46	I. Sh.I.		5	13	III. Ec.D.						19	59	I. Tr.I.
	21	45	I. Tr.E.		8	25	III. Ec.R.	23	5	48	II. Oc.D.		21	00	I. Sh.I.
	22	59	I. Sh.E.		18	38	I. Oc.D.		10	46	II. Ec.R.		22	13	I. Tr.E.
	23	19	III. Oc.R.		22	04	I. Ec.R.		17	59	I. Tr.I.		23	14	I. Sh.E.
									19	05	I. Sh.I.				
8	1	13	III. Ec.D.	16	3	04	II. Oc.D.		20	13	I. Tr.E.	31	17	06	I. Oc.D.
	4	24	III. Ec.R.		8	10	II. Ec.R.		21	19	I. Sh.E.		20	23	I. Ec.R.
	16	40	I. Oc.D.		16	00	I. Tr.I.								
	20	08	I. Ec.R.		17	10	I. Sh.I.								
					18	14	I. Tr.E.	24	15	07	I. Oc.D.				
9	0	21	II. Oc.D.		19	24	I. Sh.E.		18	28	I. Ec.R.				
I. Oct. 15				II. Oct. 16				III. Oct. 15				IV. Oct. 10			
$x_2 = +2.0, y_2 = -0.2$				$x_2 = +2.6, y_2 = -0.4$				$x_1 = +1.8, y_1 = -0.5$ $x_2 = +3.5, y_2 = -0.5$				$x_1 = +4.4, y_1 = -0.9$ $x_2 = +5.1, y_2 = -0.9$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR OCTOBER

UNIVERSAL TIME



PHASES OF THE ECLIPSES

I				III			
W		*	E	W		d	E
		r				r	
II				IV			
W		*	E	W		d	E
		r				r	

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

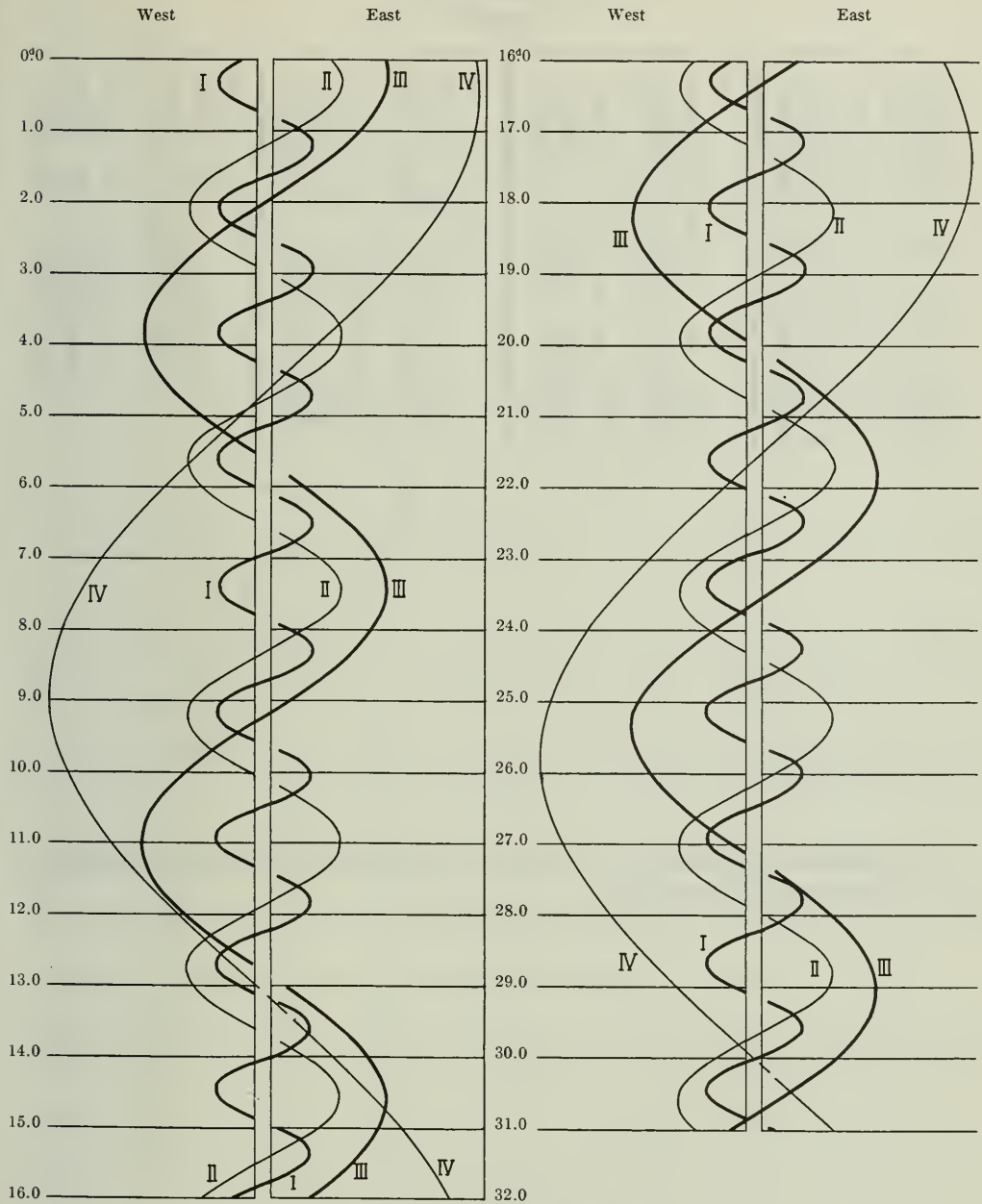
NOVEMBER

d	h	m		d	h	m		d	h	m		d	h	m	
1	2	47	II. Tr.I.	8	10	08	II. Sh.E.	15	20	44	I. Tr.E.	23	15	38	III. Tr.E.
	4	48	II. Sh.I.		16	29	I. Tr.I.		21	33	I. Sh.E.		17	38	I. Oc.D.
	5	28	II. Tr.E.		17	24	I. Sh.I.						18	34	III. Sh.E.
	7	31	II. Sh.E.		18	43	I. Tr.E.	16	7	59	III. Tr.I.		20	37	I. Ec.R.
	14	29	I. Tr.I.		19	38	I. Sh.E.		11	12	III. Tr.E.				
	15	29	I. Sh.I.						11	20	III. Sh.I.	24	6	20	II. Oc.D.
	16	42	I. Tr.E.	9	3	38	III. Tr.I.		14	34	III. Sh.E.		10	30	II. Ec.R.
	17	43	I. Sh.E.		6	47	III. Tr.E.		15	37	I. Oc.D.		15	00	I. Tr.I.
	23	17	III. Tr.I.		7	20	III. Sh.I.		18	42	I. Ec.R.		15	42	I. Sh.I.
					10	33	III. Sh.E.						17	15	I. Tr.E.
2	2	25	III. Tr.E.		13	36	I. Oc.D.	17	3	32	II. Oc.D.		17	57	I. Sh.E.
	3	20	III. Sh.I.		16	47	I. Ec.R.		7	54	II. Ec.R.				
	6	32	III. Sh.E.						13	00	I. Tr.I.	25	12	09	I. Oc.D.
	11	36	I. Oc.D.	10	0	44	II. Oc.D.		13	47	I. Sh.I.		15	06	I. Ec.R.
	14	52	I. Ec.R.		5	18	II. Ec.R.		15	14	I. Tr.E.				
	21	57	II. Oc.D.		10	59	I. Tr.I.		16	02	I. Sh.E.	26	0	34	II. Tr.I.
					11	53	I. Sh.I.						1	56	II. Sh.I.
3	2	41	II. Ec.R.		13	13	I. Tr.E.	18	10	07	I. Oc.D.		3	18	II. Tr.E.
	8	59	I. Tr.I.		14	07	I. Sh.E.		13	11	I. Ec.R.		4	41	II. Sh.E.
	9	58	I. Sh.I.						21	45	II. Tr.I.		9	31	I. Tr.I.
	11	13	I. Tr.E.	11	8	07	I. Oc.D.		23	19	II. Sh.I.		10	11	I. Sh.I.
	12	12	I. Sh.E.		11	16	I. Ec.R.						11	45	I. Tr.E.
					18	57	II. Tr.I.	19	0	28	II. Tr.E.		12	26	I. Sh.E.
4	6	06	I. Oc.D.		20	43	II. Sh.I.		2	04	II. Sh.E.				
	9	20	I. Ec.R.		21	39	II. Tr.E.		7	30	I. Tr.I.	27	2	31	III. Oc.D.
	14	17	IV. Tr.I.		23	27	II. Sh.E.		8	16	I. Sh.I.		6	39	I. Oc.D.
	15	24	IV. Tr.E.						9	44	I. Tr.E.		8	29	III. Ec.R.
	16	10	II. Tr.I.	12	5	29	I. Tr.I.		10	31	I. Sh.E.		9	35	I. Ec.R.
	18	06	II. Sh.I.		6	21	I. Sh.I.		22	05	III. Oc.D.		19	45	II. Oc.D.
	18	51	II. Tr.E.		7	43	I. Tr.E.						23	47	II. Ec.R.
	20	50	II. Sh.E.		8	36	I. Sh.E.	20	4	28	III. Ec.R.				
	23	14	IV. Sh.I.		17	41	III. Oc.D.		4	38	I. Oc.D.	28	4	01	I. Tr.I.
					20	53	III. Oc.R.		7	40	I. Ec.R.		4	40	I. Sh.I.
5	1	15	IV. Sh.E.		21	13	III. Ec.D.		16	56	II. Oc.D.		6	16	I. Tr.E.
	3	29	I. Tr.I.						21	12	II. Ec.R.		6	54	I. Sh.E.
	4	26	I. Sh.I.	13	0	28	III. Ec.R.								
	5	43	I. Tr.E.		1	40	IV. Oc.D.	21	2	00	I. Tr.I.	29	1	09	I. Oc.D.
	6	41	I. Sh.E.		2	37	I. Oc.D.		2	45	I. Sh.I.		4	03	I. Ec.R.
	13	19	III. Oc.D.		3	17	IV. Oc.R.		4	14	I. Tr.E.		13	59	II. Tr.I.
	16	29	III. Oc.R.		5	44	I. Ec.R.		5	00	I. Sh.E.		15	15	II. Sh.I.
	17	13	III. Ec.D.		9	30	IV. Ec.D.		10	18	IV. Tr.I.		16	43	II. Tr.E.
	20	27	III. Ec.R.		11	47	IV. Ec.R.		12	00	IV. Tr.E.		18	00	II. Sh.E.
					14	08	II. Oc.D.		17	12	IV. Sh.I.		21	51	IV. Oc.D.
6	0	36	I. Oc.D.		18	36	II. Ec.R.		19	30	IV. Sh.E.		22	31	I. Tr.I.
	3	49	I. Ec.R.		23	59	I. Tr.I.		23	08	I. Oc.D.		23	08	I. Sh.I.
	11	21	II. Oc.D.										23	57	IV. Oc.R.
	15	59	II. Ec.R.	14	0	50	I. Sh.I.		22	2	08	I. Ec.R.			
	21	59	I. Tr.I.		2	13	I. Tr.E.		11	10	II. Tr.I.	30	0	46	I. Tr.E.
	22	55	I. Sh.I.		3	05	I. Sh.E.		12	38	II. Sh.I.		1	23	I. Sh.E.
					21	07	I. Oc.D.		13	53	II. Tr.E.		3	28	IV. Ec.D.
7	0	13	I. Tr.E.						15	23	II. Sh.E.		6	00	IV. Ec.R.
	1	09	I. Sh.E.	15	0	13	I. Ec.R.		20	30	I. Tr.I.		16	52	III. Tr.I.
	19	06	I. Oc.D.		8	21	II. Tr.I.		21	14	I. Sh.I.		19	19	III. Sh.I.
	22	18	I. Ec.R.		10	01	II. Sh.I.		22	45	I. Tr.E.		19	40	I. Oc.D.
					11	03	II. Tr.E.		23	28	I. Sh.E.		20	05	III. Tr.E.
8	5	34	II. Tr.I.		12	46	II. Sh.E.						22	32	I. Ec.R.
	7	25	II. Sh.I.		18	30	I. Tr.I.	23	12	26	III. Tr.I.		22	35	III. Sh.E.
	8	15	II. Tr.E.		19	19	I. Sh.I.		15	21	III. Sh.I.				
I. Nov. 16				II. Nov. 17				III. Nov. 12-13				IV. Nov. 13			
$x_2 = +1.7, y_2 = -0.2$				$x_2 = +2.0, y_2 = -0.3$				$x_1 = +1.0, y_1 = -0.5$ $x_2 = +2.8, y_2 = -0.5$				$x_1 = +2.9, y_1 = -0.9$ $x_2 = +3.8, y_2 = -0.9$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR NOVEMBER

UNIVERSAL TIME



PHASES OF THE ECLIPSES

I				III			
W		*	E	W		*	E
		r				r	
II				IV			
W		*	E	W		* *	E
		r				d r	

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

DECEMBER

d	h	m		d	h	m		d	h	m		d	h	m	
1	9	09	II. Oc.D.	4	6	58	III. Oc.D.	7	0	33	I. Tr.I.	8	19	31	I. Sh.I.
	13	05	II. Ec.R.		8	40	I. Oc.D.		1	03	I. Sh.I.		21	18	I. Tr.E.
	17	02	I. Tr.I.		11	30	I. Ec.R.		2	47	I. Tr.E.		21	46	I. Sh.E.
	17	37	I. Sh.I.		12	29	III. Ec.R.		3	18	I. Sh.E.				
	19	16	I. Tr.E.		22	34	II. Oc.D.		21	19	III. Tr.I.	9	16	12	I. Oc.D.
	19	52	I. Sh.E.						21	41	I. Oc.D.		18	56	I. Ec.R.
				5	2	23	II. Ec.R.		23	18	III. Sh.I.				
2	14	10	I. Oc.D.		6	02	I. Tr.I.					10	6	15	II. Tr.I.
	17	01	I. Ec.R.		6	34	I. Sh.I.	8	0	27	I. Ec.R.		7	09	II. Sh.I.
					8	17	I. Tr.E.		0	33	III. Tr.E.		9	00	II. Tr.E.
3	3	24	II. Tr.I.		8	49	I. Sh.E.		2	34	III. Sh.E.		9	56	II. Sh.E.
	4	33	II. Sh.I.						6	42	IV. Tr.I.		13	33	I. Tr.I.
	6	08	II. Tr.E.	6	3	11	I. Oc.D.		8	54	IV. Tr.E.		14	00	I. Sh.I.
	7	18	II. Sh.E.		5	58	I. Ec.R.		11	13	IV. Sh.I.		15	48	I. Tr.E.
	11	32	I. Tr.I.		16	49	II. Tr.I.		11	58	II. Oc.D.		16	15	I. Sh.E.
	12	06	I. Sh.I.		17	51	II. Sh.I.		13	45	IV. Sh.E.				
	13	47	I. Tr.E.		19	34	II. Tr.E.		15	41	II. Ec.R.				
	14	20	I. Sh.E.		20	37	II. Sh.E.		19	03	I. Tr.I.				

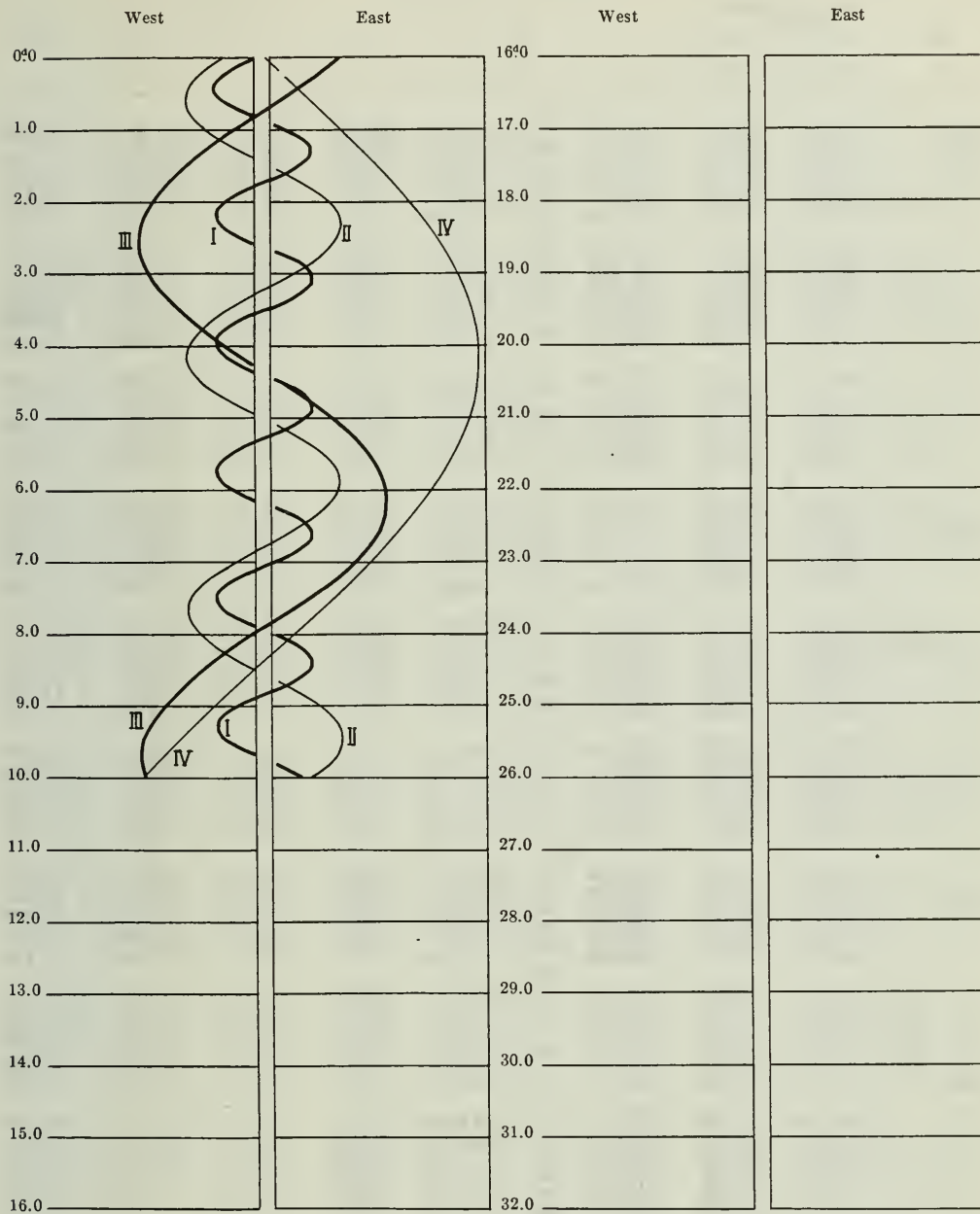
By reason of the proximity of JUPITER to the SUN the phenomena of the satellites are not given after December 10.

I. Dec. 9	II. Dec. 8	III. Dec. 4	IV
$x_2=+1.4, y_2=-0.2$	$x_2=+1.6, y_2=-0.3$	$x_2=+2.1, y_2=-0.4$	No eclipse




NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR DECEMBER

UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		III	
W		E	
II		IV	
W		E	No eclipse

RINGS OF SATURN, 1960
FOR 0^h UNIVERSAL TIME

Date		Axes of outer edge of outer ring		U	B	P	U'	B'	P'
		Major	Minor						
		"	"	°	°	°	°	°	°
Jan.	-1	33.98	14.71	153.801	+25.654	+6.458	112.774	+25.571	+10.494
	3	33.98	14.67	154.317 ⁺⁵¹⁶	25.572	6.485	112.906	25.554	10.552
	7	34.00	14.63	154.831 ⁵¹⁴	25.488	6.511	113.038	25.537	10.611
	11	34.02	14.60	155.342 ⁵¹¹	25.403	6.537	113.170	25.520	10.669
	15	34.06	14.57	155.849 ⁵⁰⁷	25.316	6.561	113.302	25.503	10.727
				502					
	19	34.12	14.54	156.351	+25.228	+6.585	113.434	+25.485	+10.785
	23	34.18	14.52	156.846 ⁺⁴⁹⁵	25.139	6.608	113.566	25.468	10.843
	27	34.26	14.51	157.333 ⁴⁸⁷	25.050	6.630	113.698	25.450	10.901
	31	34.35	14.50	157.810 ⁴⁷⁷	24.961	6.651	113.829	25.432	10.958
	Feb. 4	34.45	14.49	158.277 ⁴⁶⁷	24.872	6.671	113.961	25.414	11.016
				455					
	8	34.57	14.49	158.732	+24.784	+6.690	114.093	+25.396	+11.074
	12	34.69	14.50	159.174 ⁺⁴⁴²	24.697	6.708	114.225	25.378	11.132
	16	34.83	14.51	159.601 ⁴²⁷	24.611	6.725	114.357	25.360	11.189
	20	34.98	14.52	160.013 ⁴¹²	24.527	6.741	114.488	25.341	11.247
	24	35.14	14.54	160.408 ³⁹⁵	24.445	6.756	114.620	25.323	11.304
				377					
Mar.	28	35.31	14.57	160.785	+24.366	+6.770	114.751	+25.304	+11.361
	3	35.50	14.60	161.144 ⁺³⁵⁹	24.290	6.783	114.883	25.285	11.419
	7	35.69	14.64	161.482 ³³⁸	24.217	6.795	115.015	25.267	11.476
	11	35.89	14.68	161.800 ³¹⁸	24.148	6.806	115.146	25.248	11.533
	15	36.10	14.73	162.095 ²⁹⁵	24.083	6.816	115.278	25.229	11.590
				273					
Apr.	19	36.32	14.78	162.368	+24.023	+6.825	115.409	+25.209	+11.647
	23	36.54	14.84	162.618 ⁺²⁵⁰	23.968	6.833	115.540	25.190	11.704
	27	36.77	14.91	162.843 ²²⁵	23.918	6.840	115.672	25.171	11.761
	31	37.01	14.98	163.043 ²⁰⁰	23.873	6.846	115.803	25.151	11.818
	4	37.26	15.06	163.216 ¹⁷³	23.834	6.851	115.934	25.131	11.875
				148					
	8	37.51	15.14	163.364	+23.801	+6.856	116.066	+25.111	+11.932
	12	37.76	15.22	163.485 ⁺¹²¹	23.774	6.860	116.197	25.092	11.988
	16	38.01	15.31	163.578 ⁹³	23.754	6.862	116.328	25.072	12.045
	20	38.27	15.41	163.645 ⁶⁷	23.740	6.864	116.459	25.051	12.101
	24	38.52	15.50	163.683 ³⁸	23.733	6.866	116.590	25.031	12.158
				+ 11					
May	28	38.78	15.61	163.694	+23.733	+6.866	116.721	+25.011	+12.214
	2	39.03	15.71	163.677 ^{- 17}	23.739	6.865	116.852	24.990	12.270
	6	39.28	15.82	163.633 ⁴⁴	23.752	6.864	116.983	24.970	12.327
	10	39.52	15.93	163.562 ⁷¹	23.772	6.862	117.114	24.949	12.383
	14	39.75	16.04	163.465 ⁹⁷	23.798	6.859	117.245	24.928	12.439
				123					
	18	39.98	16.15	163.342	+23.830	+6.856	117.376	+24.907	+12.495
	22	40.19	16.26	163.195 ⁻¹⁴⁷	23.868	6.852	117.507	24.886	12.551
	26	40.40	16.37	163.024 ¹⁷¹	23.911	6.847	117.638	24.865	12.607
	30	40.59	16.48	162.830 ¹⁹⁴	23.960	6.841	117.768	24.843	12.663
	June 3	40.77	16.59	162.615 ²¹⁵	24.014	6.834	117.899	24.822	12.718
				234					
	7	40.93	16.69	162.381	+24.072	+6.827	118.030	+24.801	+12.774
	11	41.07	16.79	162.129 ⁻²⁵²	24.134	6.819	118.161	24.779	12.830
	15	41.20	16.89	161.862 ²⁶⁷	24.199	6.810	118.291	24.757	12.885
	19	41.31	16.98	161.581 ²⁸¹	24.266	6.800	118.422	24.735	12.941
	23	41.40	17.06	161.288 ²⁹³	24.336	6.791	118.552	24.713	12.996
				302					
July	27	41.46	17.13	160.986	+24.408	+6.780	118.683	+24.691	+13.051
	1	41.51	17.20	160.678 ⁻³⁰⁸	+24.481	+6.769	118.813	+24.669	+13.107

Factors by which axes of outer edge of outer ring are to be multiplied to obtain axes of:

Inner edge of outer ring 0.8801	Inner edge of inner ring 0.6650
Outer edge of inner ring 0.8599	Inner edge of dusky ring 0.5486

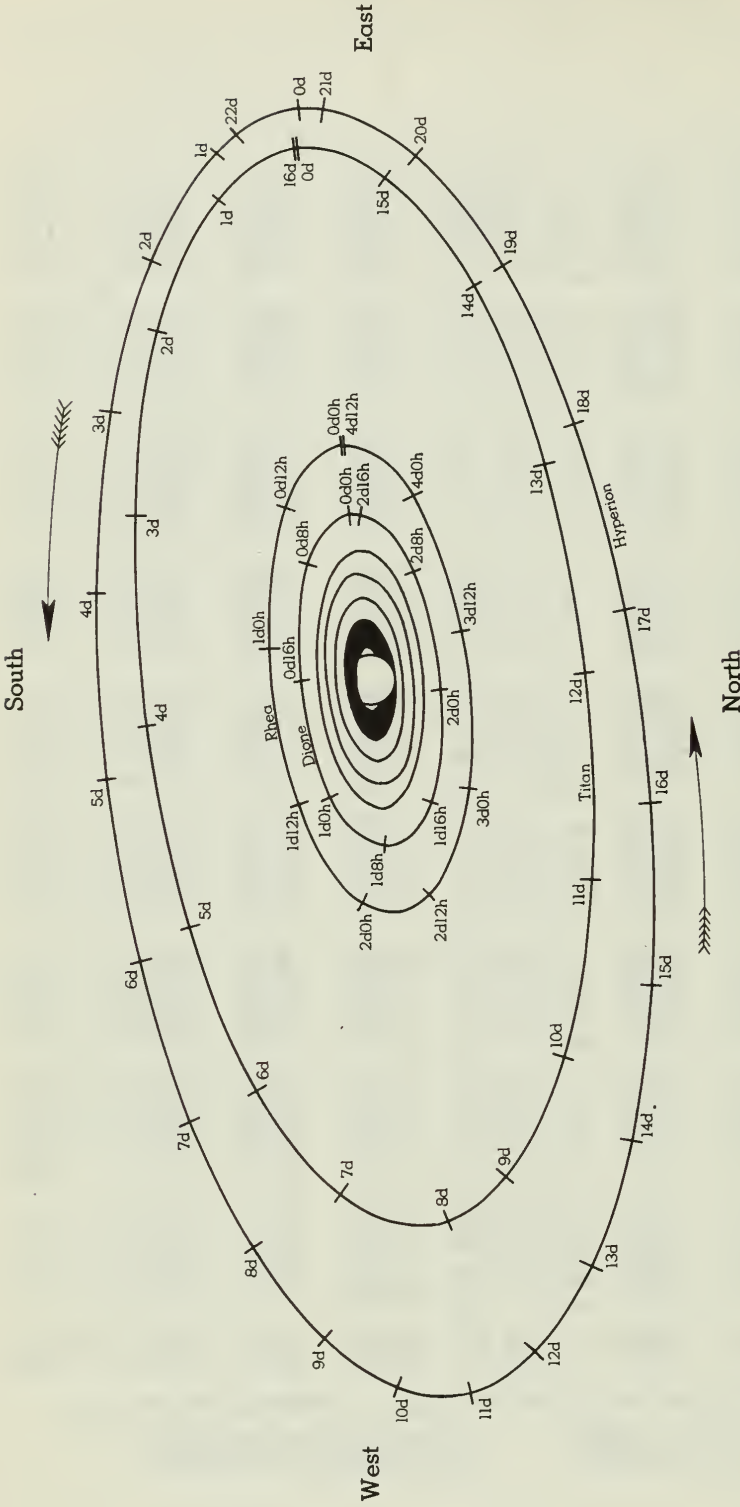
FOR 0^h UNIVERSAL TIME

Date	Axes of outer edge of outer ring		<i>U</i>	<i>B</i>	<i>P</i>	<i>U'</i>	<i>B'</i>	<i>P'</i>
	Major	Minor						
July 1	41.51	17.20	160.678	°	+6.769	118.813	+24.669	+13.107
5	41.53	17.26	160.365	-313	6.758	118.944	24.647	13.162
9	41.54	17.31	160.050	315	6.746	119.074	24.624	13.217
13	41.52	17.35	159.737	313	6.734	119.204	24.601	13.272
17	41.48	17.38	159.426	311	6.723	119.334	24.579	13.327
				305				
21	41.41	17.40	159.121	°	+6.711	119.465	+24.556	+13.382
25	41.33	17.41	158.825	-296	6.699	119.595	24.533	13.436
29	41.23	17.40	158.539	286	6.688	119.725	24.510	13.491
Aug. 2	41.10	17.39	158.267	272	6.676	119.855	24.487	13.546
6	40.96	17.37	158.010	257	6.666	119.985	24.464	13.600
				240				
10	40.80	17.34	157.770	°	+6.656	120.115	+24.440	+13.655
14	40.63	17.30	157.550	-220	6.646	120.245	24.417	13.709
18	40.44	17.24	157.350	200	6.638	120.375	24.393	13.764
22	40.24	17.18	157.173	177	6.630	120.505	24.370	13.818
26	40.03	17.12	157.019	154	6.624	120.635	24.346	13.872
				128				
30	39.80	17.04	156.891	°	+6.618	120.765	+24.322	+13.926
Sept. 3	39.57	16.96	156.790	-101	6.614	120.895	24.298	13.980
7	39.33	16.87	156.715	75	6.611	121.024	24.274	14.034
11	39.09	16.77	156.668	47	6.609	121.154	24.250	14.088
15	38.84	16.67	156.648	-20	6.608	121.284	24.225	14.142
				+9				
19	38.59	16.57	156.657	°	+6.609	121.413	+24.201	+14.195
23	38.33	16.46	156.695	+38	6.611	121.543	24.176	14.249
27	38.08	16.35	156.761	66	6.614	121.672	24.151	14.303
Oct. 1	37.82	16.23	156.856	95	6.619	121.802	24.127	14.356
5	37.57	16.12	156.978	122	6.625	121.931	24.102	14.409
				150				
9	37.33	16.00	157.128	°	+6.632	122.061	+24.077	+14.463
13	37.08	15.88	157.305	+177	6.640	122.190	24.052	14.516
17	36.84	15.75	157.508	203	6.649	122.320	24.026	14.569
21	36.61	15.63	157.737	229	6.660	122.449	24.001	14.622
25	36.38	15.51	157.990	253	6.671	122.578	23.975	14.675
				277				
29	36.17	15.39	158.267	°	+6.683	122.707	+23.950	+14.728
Nov. 2	35.96	15.27	158.567	+300	6.696	122.837	23.924	14.781
6	35.76	15.15	158.889	322	6.709	122.966	23.898	14.834
10	35.56	15.04	159.232	343	6.723	123.095	23.872	14.886
14	35.38	14.92	159.593	361	6.738	123.224	23.846	14.939
				380				
18	35.21	14.81	159.973	°	+6.753	123.353	+23.820	+14.992
22	35.05	14.70	160.370	+397	6.768	123.482	23.794	15.044
26	34.90	14.59	160.783	413	6.783	123.611	23.768	15.096
30	34.76	14.48	161.210	427	6.799	123.740	23.741	15.149
Dec. 4	34.64	14.38	161.650	440	6.814	123.868	23.715	15.201
				452				
8	34.52	14.28	162.102	°	+6.829	123.997	+23.688	+15.253
12	34.42	14.18	162.565	+463	6.845	124.126	23.661	15.305
16	34.33	14.09	163.037	472	6.860	124.255	23.634	15.357
20	34.25	14.00	163.516	479	6.874	124.383	23.607	15.409
24	34.19	13.91	164.002	486	6.888	124.512	23.580	15.460
				492				
28	34.14	13.83	164.494	°	+6.902	124.640	+23.553	+15.512
32	34.10	13.75	164.989	+495	6.916	124.769	+23.526	+15.564

Factors by which axes of outer edge of outer ring are to be multiplied to obtain axes of:

Inner edge of outer ring 0.8801
Outer edge of inner ring 0.8599

Inner edge of inner ring 0.6650
Inner edge of dusky ring 0.5486



APPARENT ORBITS OF THE SEVEN INNER SATELLITES, AT DATE OF
OPPOSITION, JULY 7

NAME	MEAN SYNODIC PERIOD		NAME	MEAN SYNODIC PERIOD	
	d	h		d	h
I Mimas	0	22.6	VI Titan	15	23.3
II Enceladus	1	08.9	VII Hyperion	21	07.6
III Tethys	1	21.3	VIII Iapetus	79	22.1
IV Dione	2	17.7	IX Phoebe	523	15.6
V Rhea	4	12.5			

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
MIMAS									
d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
1 20.4	1 00.3	1 04.0	1 06.3	1 09.9	1 12.2	1 14.5	1 18.3	1 20.9	
2 19.1	1 22.9	2 02.6	2 04.9	2 08.5	2 10.8	2 13.1	2 17.0	2 19.5	
3 17.7	2 21.5	3 01.2	3 03.5	3 07.1	3 09.4	3 11.7	3 15.6	3 18.2	
4 16.3	3 20.1	3 23.9	4 02.1	4 05.7	4 08.0	4 10.4	4 14.2	4 16.8	
5 14.9	4 18.7	4 22.5	5 00.7	5 04.4	5 06.6	5 09.0	5 12.8	5 15.4	
6 13.5	5 17.4	5 21.1	5 23.4	6 03.0	6 05.2	6 07.6	6 11.4	6 14.0	
7 12.2	6 16.0	6 19.7	6 22.0	7 01.6	7 03.8	7 06.2	7 10.1	7 12.6	
8 05.5	8 10.8	7 14.6	7 18.3	7 20.6	8 00.2	8 02.5	8 04.8	8 08.7	8 11.3
9 04.1	9 09.4	8 13.2	8 16.9	8 19.2	8 22.8	9 01.1	9 03.4	9 07.3	9 09.9
10 02.7	10 08.0	9 11.8	9 15.5	9 17.8	9 21.4	9 23.7	10 02.1	10 05.9	10 08.5
11 01.4	11 06.6	10 10.4	10 14.2	10 16.4	10 20.0	10 22.3	11 00.7	11 04.6	11 07.1
12 00.0	12 05.3	11 09.1	11 12.8	11 15.0	11 18.6	11 20.9	11 23.3	12 03.2	12 05.8
12 22.6	13 03.9	12 07.7	12 11.4	12 13.6	12 17.3	12 19.5	12 21.9	13 01.8	13 04.4
13 21.2	14 02.5	13 06.3	13 10.0	13 12.3	13 15.9	13 18.2	13 20.5	14 00.4	14 03.0
14 19.9	15 01.1	14 04.9	14 08.6	14 10.9	14 14.5	14 16.8	14 19.2	14 23.1	15 01.6
15 18.5	15 23.7	15 03.5	15 07.2	15 09.5	15 13.1	15 15.4	15 17.8	15 21.7	16 00.3
16 17.1	16 22.4	16 02.2	16 05.9	16 08.1	16 11.7	16 14.0	16 16.4	16 20.3	16 22.9
17 15.7	17 21.0	17 00.8	17 04.5	17 06.7	17 10.3	17 12.6	17 15.0	17 18.9	17 21.5
18 14.4	18 19.6	17 23.5	18 03.1	18 05.3	18 08.9	18 11.2	18 13.6	18 17.5	18 20.1
19 13.0	19 18.2	18 22.0	19 01.7	19 03.9	19 07.6	19 09.9	19 12.3	19 16.2	19 18.8
20 11.6	20 16.8	19 20.6	20 00.3	20 02.5	20 06.2	20 08.5	20 10.9	20 14.8	20 17.4
21 10.2	21 15.5	20 19.2	20 22.9	21 01.2	21 04.8	21 07.1	21 09.5	21 13.4	21 16.0
22 08.8	22 14.1	21 17.9	21 21.5	21 23.8	22 03.4	22 05.7	22 08.1	22 12.0	22 14.6
23 07.5	23 12.7	22 16.5	22 20.1	22 22.4	23 02.0	23 04.3	23 06.7	23 10.7	23 13.3
24 06.1	24 11.3	23 15.1	23 18.8	23 21.0	24 00.6	24 02.9	24 05.4	24 09.3	24 11.9
25 04.7	25 09.9	24 13.7	24 17.4	24 19.6	24 23.2	25 01.6	25 04.0	25 07.9	25 10.5
26 03.3	26 08.6	25 12.3	25 16.0	25 18.2	25 21.9	26 00.2	26 02.6	26 06.5	26 09.2
27 01.9	27 07.2	26 10.9	26 14.6	26 16.8	26 20.5	26 22.8	27 01.2	27 05.2	27 07.8
28 00.6	28 05.8	27 09.5	27 13.2	27 15.5	27 19.1	27 21.4	27 23.9	28 03.8	28 06.4
28 23.2	29 04.4	28 08.2	28 11.8	28 14.1	28 17.7	28 20.0	28 22.5	29 02.4	29 05.0
29 21.8	30 03.0	29 06.8	29 10.4	29 12.7	29 16.3	29 18.6	29 21.1	30 01.0	30 03.7
	31 01.7	30 05.4	30 09.1	30 11.3	30 14.9	30 17.3	30 19.7	30 23.7	
			31 07.7		31 13.5	31 15.9		31 22.3	

TETHYS

d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
2 13.9	1 19.0	1 23.9	1 04.7	1 09.3	2 11.2	1 16.0	1 21.0	1 02.2	
4 11.2	3 16.3	3 21.2	3 02.0	3 06.6	4 08.5	3 13.3	3 18.3	2 23.5	
6 08.6	5 13.6	5 18.5	4 23.3	5 03.9	6 05.8	5 10.6	5 15.7	4 20.9	
8 22.0	8 05.9	7 11.0	7 15.8	6 20.6	7 01.2	8 03.1	7 08.0	6 18.2	
10 19.3	10 03.2	9 08.3	9 13.1	8 17.8	8 22.5	10 00.4	9 05.3	8 15.5	
12 16.6	12 00.5	11 05.6	11 10.4	10 15.1	10 19.7	11 21.7	11 02.6	11 07.6	10 12.9
14 14.0	13 21.8	13 02.9	13 07.7	12 12.4	12 17.0	13 19.0	12 23.9	13 05.0	12 10.2
16 11.3	15 19.2	15 00.2	15 05.0	14 09.7	14 14.3	15 16.3	14 21.2	15 02.3	14 07.5
18 08.6	17 16.5	16 21.5	17 02.3	16 07.0	16 11.6	17 13.6	16 18.5	16 23.6	16 04.9
20 06.0	19 13.8	18 18.8	18 23.6	18 04.3	18 08.9	19 10.9	18 15.8	18 20.9	18 02.2
22 03.3	21 11.1	20 16.1	20 20.9	20 01.6	20 06.2	21 08.2	20 13.1	20 18.2	19 23.5
24 00.6	23 08.5	22 13.4	22 18.2	21 22.9	22 03.5	23 05.5	22 10.4	22 15.6	21 20.9
25 21.9	25 05.8	24 10.7	24 15.5	23 20.2	24 00.8	25 02.8	24 07.8	24 12.9	23 18.2
27 19.3	27 03.1	26 08.0	26 12.8	25 17.4	25 22.1	27 00.1	26 05.1	26 10.2	25 15.5
29 16.6	29 00.4	28 05.3	28 10.1	27 14.7	27 19.4	28 21.4	28 02.4	28 07.6	27 12.9
	30 21.7	30 02.6	30 07.4	29 12.0	29 16.7	30 18.7	29 23.7	30 04.9	29 10.2
					31 14.0				

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
ENCELADUS									
d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
1 11.4	1 23.8	2 03.3	1 06.6	1 09.9	1 22.1	1 01.5	1 05.0	1 17.6	
2 20.3	3 08.7	3 12.2	2 15.5	2 18.8	3 06.9	2 10.3	2 13.9	3 02.5	
4 05.1	4 17.6	4 21.1	4 00.4	4 03.7	4 15.8	3 19.2	3 22.8	4 11.4	
5 14.0	6 02.5	6 05.9	5 09.3	5 12.5	6 00.7	5 04.1	5 07.7	5 20.3	
6 22.9	7 11.4	7 14.8	6 18.2	6 21.4	7 09.6	6 13.0	6 16.6	7 05.2	
8 13.0	8 07.8	8 20.3	8 23.7	8 03.0	8 06.3	8 18.5	7 21.9	8 01.5	8 14.1
9 21.9	9 16.7	10 05.2	10 08.6	9 11.9	9 15.2	10 03.3	9 06.8	9 10.4	9 23.0
11 06.8	11 01.6	11 14.1	11 17.5	10 20.8	11 00.0	11 12.2	10 15.7	10 19.2	11 07.9
12 15.7	12 10.5	12 22.9	13 02.4	12 05.7	12 08.9	12 21.1	12 00.5	12 04.1	12 16.8
14 00.6	13 19.4	14 07.8	14 11.2	13 14.5	13 17.8	14 06.0	13 09.4	13 13.0	14 01.7
15 09.5	15 04.3	15 16.7	15 20.1	14 23.4	15 02.7	15 14.9	14 18.3	14 21.9	15 10.6
16 18.4	16 13.2	17 01.6	17 05.0	16 08.3	16 11.5	16 23.7	16 03.2	16 06.8	16 19.5
18 03.3	17 22.1	18 10.5	18 13.9	17 17.2	17 20.4	18 08.6	17 12.1	17 15.7	18 04.4
19 12.2	19 07.0	19 19.4	19 22.7	19 02.0	19 05.3	19 17.5	18 21.0	19 00.6	19 13.3
20 21.1	20 15.8	21 04.2	21 07.6	20 10.9	20 14.2	21 02.4	20 05.9	20 09.5	20 22.2
22 06.0	22 00.7	22 13.1	22 16.5	21 19.8	21 23.0	22 11.3	21 14.8	21 18.4	22 07.1
23 14.9	23 09.6	23 22.0	24 01.4	23 04.7	23 07.9	23 20.2	22 23.6	23 03.3	23 16.0
24 23.8	24 18.5	25 06.9	25 10.3	24 13.5	24 16.8	25 05.0	24 08.5	24 12.2	25 00.9
26 08.7	26 03.4	26 15.8	26 19.1	25 22.4	26 01.7	26 13.9	25 17.4	25 21.1	26 09.8
27 17.6	27 12.3	28 00.7	28 04.0	27 07.3	27 10.6	27 22.8	27 02.3	27 06.0	27 18.7
29 02.5	28 21.2	29 09.5	29 12.9	28 16.2	28 19.4	29 07.7	28 11.2	28 14.9	29 03.6
	30 06.1	30 18.4	30 21.8	30 01.0	30 04.3	30 16.7	29 20.1	29 23.8	30 12.5
	31 15.0				31 13.2			31 08.7	

DIONE

d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
2 16.1	1 19.0	1 21.5	3 17.5	1 02.0	2 21.8	2 00.2	2 02.8	1 05.7	
5 09.8	4 12.7	4 15.2	6 11.2	3 19.7	5 15.5	4 17.8	4 20.5	3 23.4	
9 18.3	8 03.6	7 06.4	9 04.8	6 13.3	8 09.1	7 11.5	7 14.2	6 17.2	
12 12.0	10 21.3	10 00.1	11 22.5	9 07.0	11 02.8	10 05.2	10 07.9	9 10.9	
15 05.7	13 15.0	12 17.8	12 20.2	14 16.1	12 00.6	13 20.5	12 22.9	13 01.6	12 04.6
17 23.5	16 08.7	15 11.4	15 13.9	17 09.8	14 18.2	16 14.1	15 16.6	15 19.3	14 22.4
20 17.2	19 02.4	18 05.1	18 07.6	20 03.5	17 11.9	19 07.8	18 10.3	18 13.1	17 16.1
23 10.9	21 20.1	20 22.8	21 01.2	22 21.1	20 05.6	22 01.5	21 04.0	21 06.8	20 09.8
26 04.7	24 13.9	23 16.5	23 18.9	25 14.7	22 23.2	24 19.1	23 21.7	24 00.5	23 03.6
28 22.4	27 07.6	26 10.2	26 12.6	28 08.4	25 16.8	27 12.8	26 15.4	26 18.2	25 21.3
	30 01.3	29 03.9	29 06.2		28 10.5	30 06.5	29 09.1	29 12.0	28 15.1
			31 23.9		31 04.2				

RHEA

d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
3 04.0	3 19.5	5 10.5	1 12.6	3 02.9	3 17.2	4 07.7	1 10.3	2 01.9	
7 16.5	8 07.9	9 22.8	6 01.0	7 15.2	8 05.5	8 20.1	5 22.8	6 14.4	
9 13.2	12 05.0	12 20.4	14 11.2	10 13.3	12 03.5	12 17.8	13 08.6	10 11.3	11 03.0
14 01.8	16 17.5	17 08.8	18 23.6	15 01.6	16 15.9	17 06.2	17 21.0	14 23.8	15 15.5
18 14.3	21 06.0	21 21.2	23 12.0	19 14.0	21 04.2	21 18.6	22 09.4	19 12.3	20 04.1
23 02.9	25 18.5	26 09.6	28 00.3	24 02.3	25 16.5	26 07.0	26 21.9	24 00.8	24 16.6
27 15.4	30 07.0	30 22.1		28 14.6	30 04.8	31 19.3		28 13.3	29 05.2

UNIVERSAL TIME OF CONJUNCTIONS AND ELONGATIONS

TITAN

Eastern Elongation		Inferior Conjunction		Western Elongation		Superior Conjunction	
d	h	d	h	d	h	d	h
Feb. 16	23.0	Feb. 21	00.8	Feb. 9	05.2	Feb. 13	03.5
Mar. 3	23.3	Mar. 8	01.1	Mar. 25	05.7	Mar. 29	03.9
Mar. 19	23.2	Mar. 24	01.0	Mar. 12	05.8	Mar. 16	03.8
Apr. 4	22.7	Apr. 9	00.4	Mar. 28	05.5	Apr. 1	03.4
				Apr. 13	04.9	Apr. 17	02.6
May 20	21.8	May 24	23.4	May 29	03.7	May 3	01.3
May 6	20.4	May 10	21.9	May 15	02.1	May 18	23.6
May 22	18.6	May 26	20.0	May 31	00.1	June 3	21.5
June 7	16.4	June 11	17.6	June 15	21.7	June 19	19.2
June 23	14.0	June 27	15.0	July 1	19.1	July 5	16.6
July 9	11.4	July 13	12.3	July 17	16.4	July 21	14.1
July 25	08.8	July 29	09.7	Aug. 2	13.9	Aug. 6	11.7
Aug. 10	06.5	Aug. 14	07.3	Aug. 18	11.6	Aug. 22	09.6
Aug. 26	04.4	Aug. 30	05.3	Sept. 3	09.7	Sept. 7	07.9
Sept. 11	02.8	Sept. 15	03.8	Sept. 19	08.3	Sept. 23	06.6
Oct. 27	01.6	Oct. 1	02.8	Oct. 5	07.4	Oct. 9	05.7
Oct. 13	00.9	Oct. 17	02.2	Oct. 21	07.0	Oct. 25	05.3
Nov. 29	00.6	Nov. 2	02.1	Nov. 6	07.0	Nov. 10	05.3
Nov. 14	00.7	Nov. 18	02.4	Nov. 22	07.3	Nov. 26	05.6
Nov. 30	01.1	Dec. 4	03.0	..	..	..	..

HYPERION

Eastern Elongation		Inferior Conjunction		Western Elongation		Superior Conjunction	
d	h	d	h	d	h	d	h
Feb. 25	03.4	Feb. 8	06.1	Feb. 14	10.7	Feb. 20	14.2
Mar. 17	14.1	Mar. 29	18.2	Mar. 6	23.8	Mar. 13	01.8
Apr. 7	23.6	Mar. 22	05.4	Mar. 28	11.5	Apr. 3	12.1
Apr. 29	07.9	Apr. 12	15.3	Apr. 18	21.5	Apr. 24	21.0
		May 3	23.7	May 10	05.7	May 16	04.3
May 20	14.9	May 25	06.6	May 31	12.0	May 6	10.1
June 10	20.6	June 15	12.0	June 21	16.8	June 27	14.8
July 2	01.2	July 6	16.3	July 12	20.7	July 18	18.7
Aug. 23	05.3	July 27	20.1	July 3	00.2	July 8	22.3
Aug. 13	09.1	Aug. 17	23.9	Aug. 24	03.9	Aug. 30	02.2
Sept. 3	13.0	Sept. 8	04.1	Sept. 14	08.4	Sept. 20	06.6
Sept. 24	17.4	Sept. 29	09.0	Oct. 5	13.9	Oct. 11	11.7
Oct. 15	22.3	Oct. 20	14.7	Oct. 26	20.5	Oct. 1	17.6
Nov. 6	03.8	Nov. 10	21.1	Nov. 17	04.0	Nov. 23	00.1
Nov. 27	09.8	Dec. 2	04.3	..	..	..	..

IAPETUS

Eastern Elongation		Inferior Conjunction		Western Elongation		Superior Conjunction	
d	h	d	h	d	h	d	h
Feb. 18	14.0	Mar. 9	05.3	Mar. 30	04.9	Apr. 19	16.1
May 8	15.0	May 27	19.4	June 17	06.1	July 7	07.3
July 26	00.7	Aug. 14	00.9	Sept. 3	12.9	Sept. 23	22.8
Oct. 13	02.2	Nov. 1	13.9	Nov. 22	15.7	..	..

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)		Mimas		Enceladus		Tethys		Dione	
		p_1	$\frac{a}{\Delta}$	p_1	$\frac{a}{\Delta}$	p_1	$\frac{a}{\Delta}$	p_1	$\frac{a}{\Delta}$
		°	"	°	"	°	"	°	"
Feb.	26	+1.3	24.0	-0.2	30.8	0.0	38.1	-0.2	48.8
Mar.	2	1.2	24.2	0.2	31.0	-0.1	38.4	0.2	49.2
	7	1.1	24.3	0.2	31.2	0.1	38.6	0.2	49.5
	12	1.0	24.5	0.2	31.4	0.1	38.9	0.2	49.8
	17	+0.9	24.7	-0.2	31.7	-0.1	39.2	-0.2	50.2
	22	0.8	24.9	0.2	31.9	0.1	39.5	0.2	50.6
	27	0.6	25.1	0.2	32.2	0.1	39.8	0.1	51.0
Apr.	1	0.5	25.3	0.2	32.4	0.2	40.1	0.1	51.4
	6	0.4	25.5	0.2	32.7	0.2	40.5	0.1	51.8
	11	+0.2	25.7	-0.1	33.0	-0.2	40.8	-0.1	52.2
	16	+0.1	25.9	0.1	33.2	0.2	41.2	0.1	52.7
	21	0.0	26.1	0.1	33.5	0.2	41.5	0.1	53.2
	26	-0.2	26.3	0.1	33.8	0.3	41.8	0.1	53.6
May	1	0.3	26.6	0.1	34.1	0.3	42.2	0.1	54.0
	6	-0.5	26.8	-0.1	34.4	-0.3	42.5	-0.1	54.5
	11	0.6	27.0	0.1	34.6	0.3	42.8	0.1	54.9
	16	0.8	27.2	0.2	34.9	0.3	43.2	0.1	55.3
	21	0.9	27.4	0.2	35.1	0.4	43.5	0.1	55.7
	26	1.0	27.5	0.2	35.3	0.4	43.7	0.1	56.0
	31	-1.1	27.7	-0.2	35.5	-0.4	44.0	-0.1	56.4
June	5	1.3	27.8	0.2	35.7	0.4	44.2	0.2	56.6
	10	1.4	28.0	0.2	35.9	0.5	44.4	0.2	56.9
	15	1.5	28.1	0.2	36.0	0.5	44.6	0.2	57.1
	20	1.6	28.2	0.2	36.2	0.5	44.8	0.2	57.3
	25	-1.6	28.2	-0.2	36.2	-0.5	44.9	-0.2	57.5
	30	1.7	28.3	0.2	36.3	0.6	44.9	0.2	57.5
July	5	1.8	28.3	0.3	36.3	0.6	45.0	0.2	57.6
	10	1.9	28.3	0.3	36.4	0.6	45.0	0.2	57.6
	15	1.9	28.3	0.3	36.3	0.6	44.9	0.3	57.5
	20	-1.9	28.2	-0.3	36.2	-0.7	44.9	-0.3	57.4
	25	2.0	28.2	0.3	36.1	0.7	44.7	0.3	57.3
	30	2.0	28.1	0.3	36.0	0.7	44.6	0.3	57.1
Aug.	4	2.0	28.0	0.3	35.9	0.7	44.4	0.3	56.9
	9	2.0	27.8	0.4	35.7	0.8	44.2	0.3	56.6
	14	-2.0	27.7	-0.4	35.5	-0.8	44.0	-0.3	56.3
	19	1.9	27.5	0.4	35.3	0.8	43.7	0.3	56.0
	24	1.9	27.4	0.4	35.1	0.8	43.4	0.4	55.7
	29	1.8	27.2	0.4	34.9	0.9	43.2	0.4	55.3
Sept.	3	1.8	27.0	0.4	34.6	0.9	42.8	0.4	54.9
	8	-1.7	26.8	-0.4	34.3	-0.9	42.5	-0.4	54.5
	13	1.6	26.6	0.4	34.1	0.9	42.2	0.4	54.0
	18	1.5	26.3	0.4	33.8	0.9	41.8	0.4	53.6
	23	1.3	26.1	0.4	33.5	1.0	41.5	0.4	53.2
	28	1.2	25.9	0.4	33.2	1.0	41.2	0.4	52.7
Oct.	3	-1.1	25.7	-0.4	33.0	-1.0	40.8	-0.4	52.3
	8	0.9	25.5	0.4	32.7	1.0	40.5	0.4	51.8
	13	0.8	25.3	0.4	32.4	1.0	40.1	0.3	51.4
	18	0.6	25.1	0.4	32.2	1.0	39.8	0.3	51.0
	23	0.4	24.9	0.4	31.9	1.0	39.5	0.3	50.6
	28	-0.3	24.7	-0.3	31.7	-1.0	39.2	-0.3	50.2
Nov.	2	-0.1	24.5	0.3	31.4	1.0	38.9	0.3	49.9
	7	+0.1	24.3	0.3	31.2	1.1	38.7	0.3	49.5
	12	+0.2	24.2	-0.3	31.0	-1.1	38.4	-0.2	49.2

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	Mimas		Time from Eastern Elongation	Enceladus		Tethys		Time from Eastern Elongation	Dione	
	p_1	F		p_1	F	p_1	F		p_1	F
h	°		d h	°		°		d h	°	
0.0	97.0	1.000	0 00	97.0	1.000	97.0	1.000	0 00	97.0	1.000
0.5	100.3	0.992	0 01	101.6	0.985	100.2	0.992	0 02	101.6	0.985
1.0	103.6	0.968	0 02	106.5	0.941	103.5	0.968	0 04	106.5	0.941
1.5	107.2	0.929	0 03	112.0	0.870	107.0	0.929	0 06	112.1	0.870
2.0	111.2	0.876	0 04	118.7	0.777	110.9	0.876	0 08	118.8	0.777
2.5	115.8	0.812	0 05	127.5	0.670	115.4	0.810	0 10	127.6	0.669
3.0	121.2	0.737	0 06	139.6	0.560	120.7	0.735	0 12	139.8	0.559
3.5	127.9	0.657	0 07	157.3	0.466	127.3	0.654	0 14	157.5	0.466
4.0	136.5	0.575	0 08	181.2	0.418	135.8	0.571	0 16	181.5	0.418
4.5	147.9	0.499	0 09	206.8	0.437	147.1	0.494	0 18	207.1	0.438
5.0	162.7	0.440	0 10	227.4	0.515	162.0	0.433	0 20	227.6	0.516
5.5	181.0	0.410	0 11	241.7	0.620	180.5	0.402	0 22	241.8	0.622
6.0	200.3	0.417	0 12	251.7	0.731	200.2	0.408	1 00	251.8	0.733
6.5	217.4	0.460	0 13	259.2	0.831	217.6	0.452	1 02	259.3	0.833
7.0	230.9	0.527	0 14	265.2	0.912	231.2	0.519	1 04	265.3	0.914
7.5	241.1	0.606	0 15	270.3	0.969	241.4	0.600	1 06	270.4	0.970
8.0	248.9	0.688	0 16	275.0	0.997	249.2	0.682	1 08	275.1	0.997
8.5	255.0	0.766	0 17	279.6	0.995	255.3	0.762	1 10	279.6	0.995
9.0	260.1	0.838	0 18	284.3	0.964	260.3	0.834	1 12	284.4	0.963
9.5	264.4	0.898	0 19	289.5	0.904	264.5	0.896	1 14	289.6	0.903
10.0	268.2	0.946	0 20	295.6	0.820	268.2	0.944	1 16	295.8	0.818
10.5	271.7	0.979	0 21	303.3	0.718	271.7	0.978	1 18	303.5	0.716
11.0	275.0	0.997	0 22	313.7	0.608	274.9	0.997	1 20	314.1	0.605
11.5	278.2	0.999	0 23	328.6	0.504	278.1	0.999	1 22	329.2	0.501
12.0	281.5	0.985	1 00	350.0	0.432	281.3	0.985	2 00	350.7	0.431
12.5	285.0	0.955	1 01	15.8	0.420	284.7	0.956	2 02	16.6	0.421
13.0	288.7	0.911	1 02	39.1	0.475	288.3	0.912	2 04	39.8	0.478
13.5	292.9	0.853	1 03	56.0	0.572	292.4	0.854	2 06	56.5	0.576
14.0	297.7	0.784	1 04	67.7	0.683	297.1	0.785	2 08	68.0	0.687
14.5	303.6	0.707	1 05	76.1	0.789	302.8	0.708	2 10	76.4	0.792
15.0	310.9	0.625	1 06	82.7	0.879	310.0	0.625	2 12	82.9	0.882
15.5	320.5	0.545	1 07	88.1	0.947	319.3	0.543	2 14	88.3	0.949
16.0	333.1	0.474	1 08	92.9	0.988	331.8	0.470	2 16	93.1	0.989
16.5	349.4	0.425	1 09	97.5	1.000	348.1	0.418	2 18	97.7	1.000
17.0	8.4	0.408	1 10	102.1	0.981	7.4	0.400	2 20	102.4	0.980
17.5	27.2	0.430	1 11			26.6	0.420			
18.0	43.0	0.483	1 12			42.8	0.473			
18.5	55.1	0.556	1 13			55.1	0.546			
19.0	64.3	0.637	1 14			64.3	0.628			
19.5	71.4	0.718	1 15			71.5	0.711			
20.0	77.0	0.795	1 16			77.1	0.788			
20.5	81.8	0.862	1 17			81.8	0.857			
21.0	85.9	0.918	1 18			85.8	0.914			
21.5	89.5	0.960	1 19			89.5	0.958			
22.0	93.0	0.988	1 20			92.8	0.986			
22.5	96.2	1.000	1 21			96.0	0.999			
23.0	99.5	0.995	1 22			99.2	0.996			

Position angle of satellite is $p_1 + p_2$ Apparent distance of satellite is $F \frac{a}{\Delta}$

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)		Rhea		Titan		Hyperion		Iapetus	
		p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$
		°	"	°	"	°	"	°	"
Feb.	26	0.0	68.2	0.0	158	+0.1	192	+0.1	461
Mar.	2	0.0	68.6	+0.1	159	0.1	193	0.0	464
	7	+0.1	69.1	0.1	160	0.2	194	-0.1	467
	12	0.1	69.6	0.1	161	0.2	196	0.2	470
	17	+0.1	70.1	+0.1	162	+0.2	197	-0.3	473
	22	0.1	70.7	0.1	164	0.2	199	0.3	477
	27	0.1	71.2	0.1	165	0.2	200	0.4	481
Apr.	1	0.1	71.8	0.1	166	0.2	202	0.5	485
	6	0.1	72.4	0.1	168	0.2	204	0.5	489
	11	+0.1	73.0	+0.1	169	+0.2	205	-0.6	493
	16	0.1	73.6	0.1	171	0.2	207	0.6	497
	21	0.1	74.2	0.1	172	0.2	209	0.6	501
	26	0.1	74.8	0.1	173	0.2	210	0.6	505
May	1	0.1	75.5	0.1	175	0.2	212	0.6	510
	6	+0.1	76.1	+0.1	176	+0.2	214	-0.6	514
	11	0.1	76.6	0.1	178	0.2	215	0.6	518
	16	0.1	77.2	0.1	179	0.2	217	0.5	521
	21	0.1	77.7	0.1	180	0.2	219	0.5	525
	26	0.1	78.2	0.1	181	0.2	220	0.5	528
	31	+0.1	78.7	+0.1	182	+0.2	221	-0.4	531
June	5	0.1	79.1	0.1	183	0.2	222	0.3	534
	10	0.1	79.5	0.1	184	0.2	223	0.3	537
	15	0.1	79.8	0.1	185	0.2	224	0.2	539
	20	0.1	80.0	0.1	185	0.2	225	-0.1	540
	25	+0.1	80.2	+0.1	186	+0.2	226	0.0	542
	30	0.0	80.4	+0.1	186	0.1	226	+0.1	543
July	5	0.0	80.4	0.0	186	0.1	226	0.2	543
	10	0.0	80.4	0.0	186	0.1	226	0.2	543
	15	0.0	80.4	0.0	186	0.1	226	0.3	543
	20	0.0	80.2	0.0	186	+0.1	226	+0.4	542
	25	0.0	80.0	0.0	185	0.1	225	0.5	540
	30	0.0	79.8	0.0	185	0.1	224	0.6	539
Aug.	4	0.0	79.5	0.0	184	+0.1	223	0.6	537
	9	-0.1	79.1	0.0	183	0.0	222	0.7	534
	14	-0.1	78.7	0.0	182	0.0	221	+0.8	531
	19	0.1	78.2	0.0	181	0.0	220	0.8	528
	24	0.1	77.7	-0.1	180	0.0	219	0.9	525
	29	0.1	77.2	0.1	179	0.0	217	0.9	521
Sept.	3	0.1	76.6	0.1	178	0.0	215	0.9	517
	8	-0.1	76.0	-0.1	176	0.0	214	+1.0	514
	13	0.1	75.4	0.1	175	0.0	212	1.0	510

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	Rhea		Time from Eastern Elongation	Titan		Hyperion		Time from Eastern Elongation	Iapetus	
	p_1	F		p_1	F	p_1	F		p_1	F
d h °			d h °			d h °		d h °		
0 00	97.0	1.000	0 00	97.0	0.972	97.0	0.887	0	98.0	0.972
0 03	101.2	0.988	0 10	101.1	0.961	100.6	0.881	2	99.6	0.959
0 06	105.6	0.951	0 20	105.4	0.928	104.5	0.860	4	101.4	0.923
0 09	110.5	0.892	1 06	110.1	0.872	108.5	0.825	6	103.3	0.862
0 12	116.3	0.813	1 16	115.6	0.800	113.0	0.778	8	105.6	0.779
0 15	123.4	0.720	2 02	122.3	0.713	118.2	0.720	10	108.5	0.676
0 18	132.7	0.620	2 12	131.0	0.619	124.3	0.656	12	112.6	0.560
0 21	145.6	0.524	2 22	142.8	0.527	131.8	0.588	14	118.9	0.432
1 00	163.5	0.449	3 08	159.1	0.451	141.2	0.522	16	130.7	0.303
1 03	186.2	0.419	3 18	180.0	0.412	153.1	0.466	18	157.4	0.197
1 06	209.0	0.446	4 04	202.4	0.424	167.8	0.427	20	206.5	0.180
1 09	227.3	0.518	4 14	221.4	0.483	184.4	0.413	22	239.8	0.271
1 12	240.5	0.613	5 00	235.5	0.569	200.8	0.429	24	254.1	0.398
1 15	250.1	0.714	5 10	245.6	0.665	215.3	0.470	26	261.5	0.528
1 18	257.3	0.807	5 20	253.2	0.760	226.9	0.528	28	265.9	0.650
1 21	263.1	0.887	6 06	259.1	0.845	236.1	0.599	30	269.1	0.760
2 00	268.0	0.947	6 16	264.1	0.919	243.2	0.672	32	271.4	0.855
2 03	272.5	0.986	7 02	268.3	0.975	249.0	0.746	34	273.4	0.929
2 06	276.7	1.000	7 12	272.2	1.012	253.7	0.817	36	275.0	0.985
2 09	280.9	0.989	7 22	275.9	1.027	257.7	0.883	38	276.6	1.018
2 12	285.3	0.954	8 08	279.5	1.022	261.2	0.942	40	278.0	1.028
2 15	290.2	0.897	8 18	283.3	0.996	264.3	0.994	42	279.5	1.015
2 18	295.8	0.819	9 04	287.3	0.949	267.1	1.037	44	281.1	0.979
2 21	302.8	0.727	9 14	291.9	0.883	269.7	1.071	46	282.8	0.921
3 00	312.0	0.627	10 00	297.3	0.802	272.1	1.095	48	284.7	0.843
3 03	324.6	0.530	10 10	304.0	0.709	274.5	1.109	50	287.2	0.746
3 06	342.1	0.454	10 20	312.9	0.610	276.8	1.113	52	290.4	0.632
3 09	4.5	0.419	11 06	325.1	0.516	279.2	1.106	54	295.2	0.507
3 12	27.5	0.442	11 16	342.1	0.441	281.6	1.089	56	303.3	0.375
3 15	46.2	0.512	12 02	4.1	0.405	284.1	1.062	58	320.0	0.249
3 18	59.7	0.606	12 12	26.9	0.424	286.7	1.025	60	359.0	0.171
3 21	69.5	0.707	12 22	45.6	0.488	289.6	0.978	62	46.4	0.211
4 00	76.8	0.801	13 08	59.3	0.578	292.8	0.923	64	68.9	0.329
4 03	82.7	0.882	13 18	69.1	0.675	296.5	0.858	66	79.1	0.461
4 06	87.7	0.944	14 04	76.5	0.767	300.7	0.789	68	84.7	0.588
4 09	92.2	0.984	14 14	82.4	0.847	305.8	0.714	70	88.4	0.703
4 12	96.4	1.000	15 00	87.4	0.909	312.1	0.637	72	91.2	0.802
4 15	100.6	0.991	15 10	91.8	0.951	320.2	0.561	74	93.3	0.880
			15 20	95.9	0.971	330.8	0.491	76	95.2	0.935
			16 06	100.0	0.966	344.4	0.434	78	96.9	0.966
			16 16			1.0	0.404	80	98.5	0.971
			17 02			18.9	0.402	82	100.2	0.951
			17 12			35.6	0.434			
			17 22			49.3	0.488			
			18 08			60.0	0.555			
			18 18			68.3	0.626			
			19 04			75.0	0.695			
			19 14			80.4	0.758			
			20 00			85.1	0.810			
			20 10			89.3	0.851			
			20 20			93.2	0.875			
			21 06			96.9	0.887			
			21 16			100.5	0.882			

Position angle of satellite is $p_1 + p_2$ Apparent distance of satellite is $F \frac{a}{\Delta}$

SATELLITES OF SATURN, 1960
ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date	MIMAS			ENCELADUS		TETHYS		DIONE	
	<i>L</i>	<i>M</i>	θ	<i>L</i>	<i>M</i>	<i>L</i>	θ	<i>L</i>	<i>M</i>
	°	°	°	°	°	°	°	°	°
Mar. 17	301.256	302.1	292.7	26.503	87.6	132.725	256.0	343.836	276.7
27	161.244	152.1	282.7	133.814	191.6	239.701	254.0	219.185	151.2
Apr. 6	21.232	2.1	272.7	241.125	295.5	346.677	252.0	94.534	25.7
16	241.221	212.1	262.7	348.437	39.4	93.653	250.0	329.883	260.2
26	101.209	62.1	252.7	95.750	143.4	200.630	248.1	205.232	134.7
May 6	321.198	272.0	242.7	203.063	247.3	307.606	246.1	80.581	9.3
16	181.188	122.0	232.7	310.376	351.2	54.582	244.1	315.929	243.8
26	41.177	332.0	222.7	57.690	95.2	161.558	242.1	191.278	118.3
June 5	261.167	182.0	212.6	165.004	199.1	268.534	240.1	66.627	352.8
15	121.157	32.0	202.6	272.319	303.1	15.510	238.2	301.976	227.3
25	341.147	241.9	192.6	19.635	47.0	122.486	236.2	177.325	101.8
July 5	201.137	91.9	182.6	126.951	150.9	229.463	234.2	52.673	336.3
15	61.128	301.9	172.6	234.267	254.9	336.439	232.2	288.022	210.8
25	281.119	151.9	162.6	341.584	358.8	83.415	230.2	163.370	85.3
Aug. 4	141.110	1.9	152.6	88.901	102.7	190.391	228.3	38.719	319.8
14	1.101	211.9	142.6	196.219	206.7	297.367	226.3	274.067	194.3
24	221.093	61.8	132.6	303.537	310.6	44.343	224.3	149.416	68.8
Sept. 3	81.084	271.8	122.6	50.856	54.6	151.319	222.3	24.765	303.4
13	301.076	121.8	112.6	158.175	158.5	258.295	220.3	260.113	177.9
23	161.069	331.8	102.6	265.495	262.4	5.271	218.4	135.461	52.4
Oct. 3	21.061	181.8	92.6	12.816	6.4	112.247	216.4	10.810	286.9
13	241.054	31.8	82.6	120.136	110.3	219.223	214.4	246.158	161.4
23	101.047	241.7	72.6	227.458	214.3	326.199	212.4	121.507	35.9
Nov. 2	321.040	91.7	62.6	334.779	318.2	73.175	210.4	356.855	270.4
10 ^d motion	3819.990	3810.0	-10.0	2627.3	2623.9	1906.976	-2.0	1315.349	1314.5

Date	RHEA				TITAN				
	<i>L</i>	<i>M</i>	θ	sin γ	<i>L</i>	<i>M</i>	θ	sin γ	<i>e</i>
	°	°	°		°	°	°		
Mar. 17	278.519	79.8	19.0	0.00548	183.779	358.99	227.17	0.00600	0.02895
27	355.418	156.6	18.7	0.00548	49.548	224.75	227.21	0.00600	0.02895
Apr. 6	72.318	233.4	18.4	0.00549	275.317	90.50	227.24	0.00600	0.02895
16	149.218	310.3	18.1	0.00549	141.087	316.26	227.27	0.00600	0.02895
26	226.117	27.1	17.8	0.00549	6.856	182.01	227.30	0.00599	0.02895
May 6	303.017	103.9	17.5	0.00549	232.625	47.77	227.34	0.00599	0.02895
16	19.917	180.8	17.2	0.00549	98.394	273.52	227.37	0.00599	0.02895
26	96.816	257.6	16.9	0.00549	324.163	139.28	227.40	0.00599	0.02895
June 5	173.716	334.4	16.6	0.00549	189.932	5.03	227.43	0.00599	0.02895
15	250.616	51.3	16.3	0.00550	55.701	230.79	227.46	0.00598	0.02895
25	327.515	128.1	16.0	0.00550	281.471	96.54	227.49	0.00598	0.02895
July 5	44.415	204.9	15.7	0.00550	147.240	322.30	227.52	0.00598	0.02895
15	121.315	281.8	15.3	0.00550	13.009	188.05	227.55	0.00598	0.02895
25	198.214	358.6	15.0	0.00550	238.778	53.81	227.58	0.00598	0.02895
Aug. 4	275.114	75.4	14.7	0.00550	104.547	279.56	227.61	0.00597	0.02896
14	352.014	152.3	14.4	0.00550	330.316	145.32	227.64	0.00597	0.02896
24	68.913	229.1	14.1	0.00550	196.085	11.07	227.67	0.00597	0.02896
Sept. 3	145.813	305.9	13.8	0.00551	61.854	236.83	227.70	0.00597	0.02896
13	222.713	22.8	13.5	0.00551	287.623	102.58	227.73	0.00596	0.02896
23	299.613	99.6	13.2	0.00551	153.393	328.34	227.76	0.00596	0.02896
Oct. 3	16.512	176.4	12.9	0.00551	19.162	194.09	227.78	0.00596	0.02896
13	93.412	253.3	12.6	0.00551	244.931	59.85	227.81	0.00596	0.02896
23	170.312	330.1	12.3	0.00551	110.700	285.60	227.84	0.00596	0.02896
Nov. 2	247.211	46.9	12.0	0.00551	336.469	151.35	227.87	0.00595	0.02896
10 ^d motion	796.900	796.8	-0.3	.....	225.769	225.76	0.03	.....	.....

ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date		HYPERION				IAPETUS	
		<i>L</i>	<i>M</i>	<i>e</i>	<i>a</i>	<i>L</i>	<i>M</i>
		°	°		"	°	°
Mar.	17	245.282	355.59	0.11589	2050.4	92.381	135.56
	27	53.783	164.51	0.11585	2050.0	137.762	180.94
Apr.	6	222.341	333.49	0.11579	2049.5	183.143	226.31
	16	30.962	142.54	0.11569	2049.0	228.524	271.69
	26	199.652	311.65	0.11557	2048.5	273.904	317.07
May	6	8.415	120.84	0.11543	2047.9	319.285	2.44
	16	177.257	290.11	0.11526	2047.2	4.666	47.82
	26	346.180	99.47	0.11508	2046.6	50.047	93.20
June	5	155.187	268.92	0.11489	2045.9	95.428	138.57
	15	324.280	78.45	0.11469	2045.2	140.809	183.95
	25	133.460	248.08	0.11448	2044.5	186.190	229.32
July	5	302.727	57.79	0.11427	2043.8	231.571	274.70
	15	112.081	227.60	0.11406	2043.2	276.951	320.08
	25	281.520	37.49	0.11385	2042.5	322.332	5.45
Aug.	4	91.042	207.47	0.11366	2041.8	7.713	50.83
	14	260.644	17.54	0.11348	2041.2	53.094	96.21
	24	70.323	187.68	0.11331	2040.6	98.475	141.58
Sept.	3	240.072	357.90	0.11317	2040.0	143.856	186.96
	13	49.888	168.19	0.11304	2039.5	189.237	232.33
	23	219.765	338.54	0.11294	2039.0	234.618	277.71
Oct.	3	29.695	148.95	0.11288	2038.6	279.998	323.09
	13	199.673	319.40	0.11284	2038.2	325.379	8.46
	23	9.691	129.90	0.11283	2037.9	10.760	53.84
Nov.	2	179.740	300.43	0.11286	2037.7	56.141	99.22
10 ^d motion		.....	.....	.....	.....	45.381	45.38

<i>Mimas</i>			<i>Tethys</i>			<i>Rhea</i>			<i>Titan</i>		
<i>u-U</i>	<i>F</i>	<i>u-U</i>	<i>u-U</i>	<i>F</i>	<i>u-U</i>	<i>u-U</i>	<i>F</i>	<i>u-U</i>	<i>u-U</i>	<i>F</i>	<i>u-U</i>
0.0		360.0	0.0		360.0	0.0		360.0	0.0		360.0
67.3	0.9999	292.7	43.4	0.9998	316.6	18.6	0.9996	341.4	6.8	0.9991	353.2
112.6	1.0000	247.4	75.9	0.9999	284.1	47.4	0.9997	312.6	28.8	0.9992	331.2
247.3	1.0001	112.7	104.0	1.0000	256.0	66.0	0.9998	294.0	40.5	0.9993	319.5
			136.5	1.0001	223.5	82.2	0.9999	277.8	50.0	0.9994	310.0
			223.4	1.0002	136.6	97.7	1.0000	262.3	58.2	0.9995	301.8
						113.9	1.0001	246.1	65.8	0.9996	294.2
						132.5	1.0002	227.5	73.0	0.9997	287.0
						161.3	1.0003	198.7	79.9	0.9998	280.1
						198.6	1.0004	161.4	86.6	0.9999	273.4
									93.3	1.0000	266.7
									100.0	1.0001	260.0
									106.9	1.0002	253.1
									114.1	1.0003	245.9
									121.7	1.0004	238.3
									129.9	1.0005	230.1
									139.4	1.0006	220.6
									151.1	1.0007	208.9
									173.1	1.0008	186.9
									186.8	1.0009	173.2

<i>Enceladus</i>			<i>Dione</i>		
<i>u-U</i>	<i>F</i>	<i>u-U</i>	<i>u-U</i>	<i>F</i>	<i>u-U</i>
0.0		360.0	0.0		360.0
25.9	0.9998	334.1	19.0	0.9997	341.0
72.5	0.9999	287.5	55.4	0.9998	304.6
107.4	1.0000	252.6	79.1	0.9999	280.9
154.0	1.0001	206.0	100.8	1.0000	259.2
205.9	1.0002	154.1	124.5	1.0001	235.5
			160.9	1.0002	199.1
			199.0	1.0003	161.0

In critical cases ascend

FOR 0^h UNIVERSAL TIME

Date		TITAN			HYPERION			IAPETUS		
		<i>U</i>	<i>B</i>	<i>P</i>	<i>U</i>	<i>B</i>	<i>P</i>	<i>U</i>	<i>B</i>	<i>P</i>
Jan.	- 1	158.832	+25.167	+6.808	156.850	+25.445	+6.860	232.772	+11.081	+9.559
	7	159.857	24.996	6.851	157.881	25.272	6.908	233.709	10.867	9.346
	15	160.872	24.818	6.891	158.901	25.093	6.954	234.638	10.651	9.132
	23	161.865	24.636	6.928	159.900	24.910	6.996	235.549	10.436	8.921
	31	162.825	24.453	6.962	160.866	24.725	7.035	236.431	10.225	8.713
Feb.	8	163.743	+24.272	+6.991	161.789	+24.542	+7.069	237.275	+10.019	+8.512
	16	164.609	24.095	7.018	162.660	24.364	7.100	238.072	9.822	8.321
	24	165.413	23.925	7.040	163.469	24.192	7.127	238.814	9.637	8.142
Mar.	3	166.147	23.766	7.060	164.207	24.032	7.149	239.492	9.466	7.977
	11	166.801	23.622	7.076	164.865	23.886	7.169	240.097	9.313	7.829
Apr.	19	167.368	+23.494	+7.089	165.436	+23.757	+7.184	240.622	+ 9.179	+7.700
	27	167.841	23.386	7.099	165.914	23.648	7.197	241.061	9.066	7.591
	4	168.214	23.301	7.107	166.291	23.562	7.207	241.408	8.978	7.506
	12	168.482	23.240	7.112	166.563	23.500	7.213	241.657	8.916	7.444
	20	168.642	23.205	7.116	166.727	23.465	7.217	241.807	8.880	7.407
May	28	168.692	+23.198	+7.117	166.781	+23.457	+7.219	241.854	+ 8.872	+7.395
	6	168.633	23.217	7.116	166.725	23.476	7.218	241.799	8.892	7.409
	14	168.468	23.264	7.113	166.562	23.522	7.214	241.646	8.938	7.448
	22	168.201	23.335	7.108	166.298	23.593	7.208	241.398	9.011	7.510
	30	167.839	23.428	7.102	165.939	23.687	7.199	241.063	9.107	7.594
June	7	167.393	+23.542	+7.092	165.496	+23.801	+7.188	240.651	+ 9.224	+7.696
	15	166.878	23.670	7.081	164.984	23.930	7.174	240.175	9.358	7.815
	23	166.309	23.811	7.068	164.417	24.070	7.159	239.649	9.505	7.944
July	1	165.703	23.958	7.054	163.814	24.218	7.141	239.089	9.662	8.082
	9	165.080	24.106	7.038	163.193	24.367	7.122	238.516	9.821	8.222
Aug.	17	164.461	+24.252	+7.021	162.576	+24.513	+7.102	237.946	+ 9.979	+8.361
	25	163.864	24.392	7.003	161.982	24.653	7.082	237.398	10.131	8.494
	2	163.310	24.520	6.987	161.431	24.781	7.063	236.890	10.273	8.616
	10	162.817	24.634	6.972	160.941	24.896	7.045	236.439	10.400	8.725
	18	162.401	24.732	6.958	160.527	24.994	7.030	236.057	10.510	8.816
Sept.	26	162.074	+24.811	+6.947	160.202	+25.073	+7.017	235.758	+10.599	+8.888
	3	161.847	24.870	6.940	159.978	25.132	7.009	235.551	10.665	8.937
	11	161.727	24.909	6.937	159.862	25.170	7.005	235.442	10.707	8.964
	19	161.718	24.925	6.937	159.856	25.186	7.005	235.435	10.723	8.967
	27	161.823	24.919	6.942	159.965	25.179	7.011	235.532	10.714	8.945
Oct.	5	162.040	+24.891	+6.950	160.186	+25.151	+7.020	235.732	+10.679	+8.899
	13	162.366	24.841	6.962	160.516	25.100	7.034	236.032	10.619	8.829
	21	162.797	24.769	6.978	160.951	25.026	7.051	236.428	10.534	8.736
	29	163.327	24.674	6.996	161.485	24.931	7.072	236.914	10.425	8.621
Nov.	6	163.947	24.559	7.016	162.109	24.814	7.095	237.484	10.294	8.486
Dec.	14	164.648	+24.423	+7.037	162.815	+24.677	+7.120	238.129	+10.142	+8.331
	22	165.422	24.266	7.059	163.594	24.519	7.145	238.843	9.971	8.158
	30	166.259	24.091	7.082	164.436	24.342	7.172	239.615	9.783	7.970
	8	167.148	23.899	7.103	165.330	24.148	7.197	240.436	9.579	7.768
	16	168.078	23.690	7.124	166.265	23.937	7.222	241.298	9.362	7.554
	24	169.040	+23.467	+7.142	167.232	+23.712	+7.245	242.190	+ 9.134	+7.332
	32	170.023	+23.232	+7.159	168.219	+23.475	+7.266	243.103	+ 8.897	+7.102

DIFFERENTIAL COORDINATES OF HYPERION FOR 0th UNIVERSAL TIME

Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$	Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$	Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$
	s s	" "		s s	" "		s s	" "
Feb. 8	+ 0.3	-78	May 18	+ 8.6	+51	Aug. 28	- 8.5	+94
10	- 7.3	-60	20	+13.5	- 6	30	+ 0.4	+89
12	-12.8	-25	22	+12.0	-60	Sept. 1	+ 8.9	+52
14	-15.1	+17	24	+ 5.0	-88	3	+13.5	- 6
			26	- 4.1	-83	5	+11.6	-62
16	-13.8	+55	28	-12.0	-51	7	+ 4.4	-90
18	- 8.9	+79	30	-16.8	- 5	9	- 4.5	-84
20	- 1.7	+81	June 1	-17.3	+42	11	-12.0	-51
22	+ 6.1	+56	3	-13.4	+79	13	-16.3	- 4
24	+11.4	+ 9	5	- 5.9	+94	15	-16.4	+44
26	+11.4	-42	7	+ 3.5	+78	17	-12.3	+79
28	+ 6.2	-74	9	+11.5	+32	19	- 4.9	+93
Mar. 1	- 1.7	-77	11	+14.1	-29	21	+ 4.0	+76
3	- 9.1	-54	13	+10.0	-77	23	+11.2	+29
5	-14.0	-15	15	+ 1.5	-92	25	+13.1	-30
7	-15.5	+27	17	- 7.6	-75	27	+ 8.9	-75
9	-13.2	+63	19	-14.6	-35	29	+ 0.8	-89
11	- 7.5	+83	21	-17.8	+14	1	- 7.5	-71
13	+ 0.4	+78	23	-16.5	+60	3	-13.7	-32
15	+ 8.1	+45	25	-11.0	+91	5	-16.2	+14
17	+12.3	- 6	27	- 2.2	+94	7	-14.8	+57
19	+10.8	-55	29	+ 7.2	+65	9	- 9.4	+84
21	+ 4.3	-80	1	+13.5	+ 8	11	- 1.4	+86
23	- 3.9	-74	3	+13.4	-52	13	+ 7.0	+58
25	-11.0	-45	5	+ 6.9	-89	15	+12.2	+ 5
27	-15.2	- 4	7	- 2.4	-91	17	+11.7	-49
29	-15.7	+39	9	-11.0	-62	19	+ 5.8	-82
31	-12.3	+72	11	-16.6	-16	21	- 2.4	-82
Apr. 2	- 5.6	+86	13	-17.9	+34	23	- 9.8	-56
4	+ 2.8	+72	15	-14.7	+76	25	-14.6	-15
6	+10.2	+32	17	- 7.6	+97	27	-15.6	+30
8	+12.9	-23	19	+ 1.9	+88	29	-12.7	+67
10	+ 9.6	-68	21	+10.5	+45	31	- 6.4	+85
12	+ 2.0	-83	23	+14.3	-18	Nov. 2	+ 1.8	+76
14	- 6.4	-70	25	+11.2	-72	4	+ 9.3	+37
16	-13.0	-35	27	+ 3.1	-95	6	+12.4	-17
18	-16.3	+ 9	29	- 6.2	-82	8	+ 9.7	-63
20	-15.6	+52	31	-13.7	-44	10	+ 2.8	-82
22	-11.0	+81	2	-17.5	+ 5	12	- 5.1	-72
24	- 3.2	+87	4	-16.9	+54	14	-11.5	-40
26	+ 5.7	+64	6	-12.0	+88	16	-14.9	+ 2
28	+12.1	+14	8	- 3.6	+97	18	-14.6	+43
30	+12.9	-42	10	+ 5.8	+73	20	-10.6	+73
May 2	+ 7.7	-79	12	+12.7	+20	22	- 3.4	+81
4	- 0.8	-85	14	+13.6	-42	24	+ 4.7	+61
6	- 9.2	-62	16	+ 8.1	-85	26	+10.7	+16
8	-15.0	-22	18	- 0.8	-93	28	+11.7	-36
10	-17.1	+25	20	- 9.5	-68	30	+ 7.3	-72
12	-14.9	+65	22	-15.5	-24	Dec. 2	0.0	-79
14	- 8.8	+89	24	-17.4	+26	4	- 7.4	-61
16	- 0.1	+85	26	-15.0	+69			

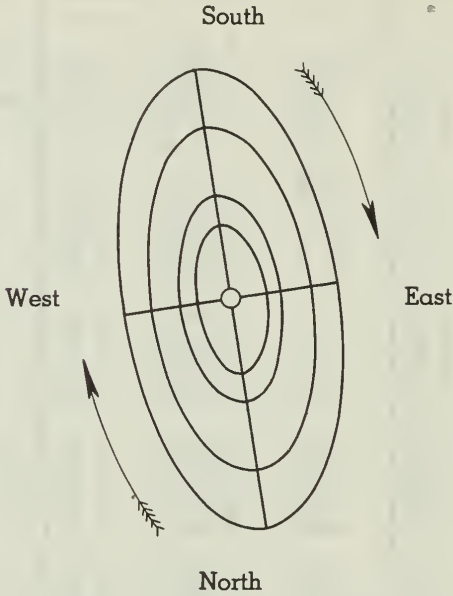
DIFFERENTIAL COORDINATES OF IAPETUS FOR 0^h UNIVERSAL TIME

Date	$\alpha_I - \alpha_{Sat.}$	$\delta_I - \delta_{Sat.}$	Date	$\alpha_I - \alpha_{Sat.}$	$\delta_I - \delta_{Sat.}$	Date	$\alpha_I - \alpha_{Sat.}$	$\delta_I - \delta_{Sat.}$
	^s s	" "		^s s	" "		^s s	" "
Feb. 8	+21.0	+ 15	May 18	+25.6	-104	Aug. 28	-34.3	+ 27
10	24.5	0	20	21.1	105	30	36.4	46
12	27.3	- 16	22	16.0	103	1	37.6	63
14	29.5	32	24	10.5	99	3	38.0	79
			26	+ 4.6	92	5	37.4	93
16	+31.0	- 47	28	- 1.4	- 82	7	-36.0	+105
18	31.6	60	30	7.4	71	9	33.8	114
20	31.4	72	1	13.2	57	11	30.8	120
22	30.4	82	3	18.8	42	13	27.1	123
24	28.6	89	5	23.9	26	15	22.8	124
26	+26.0	- 95	7	-28.4	- 9	17	-18.0	+121
28	22.8	97	9	32.3	+ 9	19	12.8	116
1	19.0	97	11	35.4	26	21	7.3	108
3	14.7	96	13	37.7	43	23	- 1.7	97
5	9.9	92	15	39.0	59	25	+ 4.0	84
7	+ 4.9	- 85	17	-39.5	+ 74	27	+ 9.5	+ 69
9	- 0.2	77	19	39.0	87	29	14.7	52
11	5.3	67	21	37.6	99	1	19.5	34
13	10.4	55	23	35.2	108	3	23.7	+ 16
15	15.3	42	25	32.0	114	5	27.3	- 3
17	-19.8	- 28	27	-28.0	+118	7	+30.2	- 22
19	23.9	- 13	29	23.3	119	9	32.2	40
21	27.5	+ 2	1	18.1	117	11	33.4	57
23	30.5	17	3	12.3	111	13	33.7	72
25	32.8	32	5	- 6.2	103	15	33.0	84
27	-34.4	+ 46	7	0.0	+ 93	17	+31.5	- 95
29	35.2	58	9	+ 6.2	79	19	29.2	103
31	35.3	70	11	12.3	63	21	26.1	108
1	34.5	80	13	18.0	46	23	22.4	110
3	32.9	88	15	23.2	27	25	18.1	110
6	-30.6	+ 94	17	+27.8	+ 7	27	+13.4	-107
8	27.5	98	19	31.6	- 12	29	8.4	101
10	23.8	100	21	34.5	32	31	+ 3.2	92
12	19.5	99	23	36.5	51	2	- 2.0	82
14	14.7	96	25	37.4	69	4	7.2	70
16	- 9.5	+ 91	27	+37.2	- 85	6	-12.1	- 56
18	- 4.0	84	29	36.0	98	8	16.7	41
20	+ 1.6	74	31	33.8	109	10	20.9	25
22	7.3	62	1	30.7	117	12	24.6	- 9
24	12.8	49	3	26.7	122	14	27.8	+ 7
26	+18.0	+ 34	6	+22.0	-123	16	-30.3	+ 22
28	22.7	19	8	16.8	121	18	32.1	37
30	26.9	+ 2	10	11.1	116	20	33.2	51
1	30.4	- 14	12	+ 5.1	107	22	33.6	63
3	33.0	30	14	- 1.0	96	24	33.3	74
6	+34.8	- 46	16	- 7.0	- 82	26	-32.2	+ 83
8	35.6	60	18	12.8	67	28	30.4	90
10	35.5	73	20	18.2	49	30	27.9	95
12	34.4	84	22	23.2	31	1	24.8	98
14	32.3	93	24	27.6	- 12	3	-21.2	+ 99
16	+29.3	-100	26	-31.3	+ 8	5	...	...

DIFFERENTIAL COORDINATES OF PHOEBE FOR 0^h UNIVERSAL TIME

Date	$\alpha_{Ph.} - \alpha_{Sat.}$	$\delta_{Ph.} - \delta_{Sat.}$	Date	$\alpha_{Ph.} - \alpha_{Sat.}$	$\delta_{Ph.} - \delta_{Sat.}$	Date	$\alpha_{Ph.} - \alpha_{Sat.}$	$\delta_{Ph.} - \delta_{Sat.}$
	m s	' "		m s	' "		m s	' "
Feb. 8	+1 52.9	+1 18	May 18	+1 32.7	-0 20	Aug. 28	-1 06.1	-1 24
10	1 54.1	1 18	20	1 30.5	0 25	30	1 08.9	1 21
12	1 55.3	1 19	22	1 28.2	0 29	Sept. 1	1 11.6	1 19
14	1 56.4	1 20	24	1 25.8	0 33	3	1 14.3	1 16
			26	1 23.3	0 38	5	1 16.9	1 14
16	+1 57.5	+1 20	28	+1 20.8	-0 42	7	-1 19.4	-1 11
18	1 58.5	1 21	30	1 18.2	0 47	9	1 21.8	1 09
20	1 59.4	1 21	June 1	1 15.6	0 51	11	1 24.2	1 06
22	2 00.3	1 21	3	1 12.9	0 55	13	1 26.5	1 04
24	2 01.1	1 21	5	1 10.1	0 59	15	1 28.7	1 01
26	+2 01.9	+1 22	7	+1 07.3	-1 03	17	-1 30.8	-0 59
28	2 02.6	1 22	9	1 04.4	1 07	19	1 32.9	0 57
Mar. 1	2 03.2	1 22	11	1 01.5	1 11	21	1 34.9	0 54
3	2 03.8	1 22	13	0 58.5	1 15	23	1 36.8	0 52
5	2 04.3	1 21	15	0 55.5	1 18	25	1 38.6	0 50
7	+2 04.7	+1 21	17	+0 52.4	-1 22	27	-1 40.3	-0 48
9	2 05.1	1 20	19	0 49.3	1 25	29	1 42.0	0 46
11	2 05.4	1 20	21	0 46.1	1 28	Oct. 1	1 43.6	0 44
13	2 05.6	1 19	23	0 42.9	1 31	3	1 45.1	0 42
15	2 05.8	1 18	25	0 39.7	1 34	5	1 46.5	0 40
17	+2 05.9	+1 17	27	+0 36.4	-1 36	7	-1 47.8	-0 38
19	2 05.9	1 16	29	0 33.1	1 39	9	1 49.0	0 36
21	2 05.8	1 15	July 1	0 29.7	1 41	11	1 50.1	0 35
23	2 05.7	1 13	3	0 26.3	1 43	13	1 51.2	0 33
25	2 05.5	1 12	5	0 22.9	1 45	15	1 52.2	0 32
27	+2 05.3	+1 10	7	+0 19.5	-1 46	17	-1 53.0	-0 30
29	2 05.0	1 08	9	0 16.1	1 48	19	1 53.8	0 29
31	2 04.6	1 06	11	0 12.6	1 49	21	1 54.5	0 28
Apr. 2	2 04.1	1 04	13	0 09.2	1 50	23	1 55.2	0 27
4	2 03.6	1 02	15	0 05.7	1 51	25	1 55.7	0 26
6	+2 02.9	+0 59	17	+0 02.2	-1 51	27	-1 56.2	-0 25
8	2 02.2	0 56	19	-0 01.2	1 51	29	1 56.6	0 24
10	2 01.5	0 54	21	0 04.7	1 52	31	1 56.8	0 23
12	2 00.6	0 51	23	0 08.2	1 52	Nov. 2	1 57.0	0 22
14	1 59.7	0 48	25	0 11.7	1 51	4	1 57.2	0 21
16	+1 58.7	+0 44	27	-0 15.1	-1 51	6	-1 57.2	-0 20
18	1 57.7	0 41	29	0 18.5	1 50	8	1 57.1	0 19
20	1 56.5	0 38	31	0 22.0	1 49	10	1 57.0	0 19
22	1 55.3	0 34	Aug. 2	0 25.4	1 48	12	1 56.8	0 18
24	1 54.0	0 30	4	0 28.7	1 47	14	1 56.5	0 17
26	+1 52.7	+0 27	6	-0 32.1	-1 46	16	-1 56.2	-0 17
28	1 51.2	0 23	8	0 35.4	1 44	18	1 55.8	0 16
30	1 49.7	0 19	10	0 38.7	1 43	20	1 55.3	0 15
May 2	1 48.1	0 15	12	0 41.9	1 41	22	1 54.7	0 15
4	1 46.4	0 11	14	0 45.1	1 39	24	1 54.0	0 14
6	+1 44.7	+0 06	16	-0 48.3	-1 37	26	-1 53.3	-0 14
8	1 42.9	+0 02	18	0 51.4	1 35	28	1 52.5	0 13
10	1 41.0	-0 02	20	0 54.4	1 33	30	1 51.6	0 12
12	1 39.0	0 07	22	0 57.4	1 31	Dec. 2	1 50.6	0 11
14	1 37.0	0 11	24	1 00.4	1 29	4	-1 49.6	-0 10
16	+1 34.9	-0 16	26	-1 03.3	-1 26	..	..	..

APPARENT ORBITS OF SATELLITES I-IV AT DATE OF OPPOSITION,
FEBRUARY 8



NAME	SIDEREAL PERIOD	
	d	h
V Miranda	1.4	
I Ariel	2	12.489
II Umbriel	4	03.460
III Titania	8	16.941
IV Oberon	13	11.118

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$				Date (0 ^h U.T.)	p_2	$\frac{a}{\Delta}$			
		Ariel	Umbriel	Titania	Oberon			Ariel	Umbriel	Titania	Oberon
	°	"	"	"	"		°	"	"	"	"
Jan. - 3	+0.4	14.9	20.8	34.2	45.7	June 5	-0.6	14.0	19.6	32.1	42.9
7	0.3	15.0	20.9	34.4	46.0	15	0.5	13.9	19.4	31.9	42.6
17	0.2	15.1	21.0	34.5	46.2	25	0.3	13.9	19.3	31.7	42.3
27	+0.1	15.2	21.1	34.6	46.3	July 5	-0.2	13.8	19.2	31.5	42.1
Feb. 6	-0.1	15.2	21.2	34.7	46.4	..	..	..	..	..	..
16	-0.3	15.2	21.1	34.7	46.4	Sept. 23	+1.4	13.8	19.2	31.5	42.1
26	0.4	15.1	21.1	34.6	46.3	Oct. 3	1.6	13.9	19.3	31.7	42.4
Mar. 7	0.6	15.1	21.0	34.5	46.1	13	1.7	14.0	19.5	31.9	42.7
17	0.7	15.0	20.9	34.3	45.9	23	1.8	14.1	19.6	32.2	43.0
27	0.8	14.9	20.8	34.1	45.6	Nov. 2	1.9	14.2	19.8	32.5	43.4
Apr. 6	-0.9	14.8	20.6	33.8	45.3	12	+1.9	14.3	20.0	32.8	43.8
16	0.9	14.7	20.5	33.6	44.9	22	2.0	14.5	20.2	33.1	44.2
26	0.9	14.6	20.3	33.3	44.5	Dec. 2	2.0	14.6	20.3	33.4	44.6
May 6	0.9	14.4	20.1	33.0	44.1	12	2.0	14.7	20.5	33.7	45.0
16	0.8	14.3	19.9	32.7	43.7	22	2.0	14.9	20.7	34.0	45.4
26	-0.8	14.2	19.7	32.4	43.3	32	+1.9	15.0	20.9	34.2	45.8

APPARENT DISTANCE AND POSITION ANGLE

Time from Northern Elongation	Ariel		Umbriel		Time from Northern Elongation	Titania		Time from Northern Elongation	Oberon	
	p_1	F	p_1	F		p_1	F		p_1	F
d h °			d h °		d h °			d h °		
0 00	9.0	1.000	9.0	1.000	0 00	9.0	1.000	0 00	9.0	1.000
0 02	3.4	0.983	5.6	0.994	0 05	5.0	0.991	0 08	4.8	0.991
0 04	357.4	0.934	2.1	0.975	0 10	0.8	0.965	0 16	0.5	0.963
0 06	350.5	0.856	358.5	0.945	0 15	356.3	0.923	1 00	355.8	0.917
0 08	342.0	0.757	354.6	0.904	0 20	351.3	0.866	1 08	350.5	0.857
0 10	330.7	0.647	350.2	0.853	1 01	345.5	0.797	1 16	344.4	0.784
0 12	314.8	0.544	345.2	0.794	1 06	338.5	0.720	2 00	336.8	0.703
0 14	293.1	0.477	339.4	0.729	1 11	329.8	0.640	2 08	327.3	0.621
0 16	267.9	0.473	332.4	0.662	1 16	318.6	0.564	2 16	315.0	0.545
0 18	245.5	0.534	323.8	0.596	1 21	304.4	0.503	3 00	299.3	0.489
0 20	229.0	0.633	313.3	0.537	2 02	287.2	0.469	3 08	280.9	0.466
0 22	217.2	0.744	300.5	0.492	2 07	268.9	0.471	3 16	262.1	0.482
1 00	208.4	0.845	285.7	0.468	2 12	251.9	0.509	4 00	245.8	0.532
1 02	201.4	0.926	270.2	0.470	2 17	238.1	0.572	4 08	232.8	0.605
1 04	195.3	0.979	255.7	0.497	2 22	227.2	0.648	4 16	222.8	0.687
1 06	189.7	1.000	243.2	0.544	3 03	218.7	0.728	5 00	215.0	0.768
1 08	184.1	0.987	232.9	0.605	3 08	211.9	0.804	5 08	208.6	0.843
1 10	178.2	0.942	224.6	0.671	3 13	206.2	0.872	5 16	203.2	0.907
1 12	171.4	0.867	217.8	0.738	3 18	201.2	0.928	6 00	198.4	0.955
1 14	163.1	0.770	212.1	0.802	3 23	196.8	0.969	6 08	194.0	0.986
1 16	152.2	0.660	207.2	0.860	4 04	192.6	0.993	6 16	189.8	1.000
1 18	137.1	0.556	202.9	0.910	4 09	188.6	1.000	7 00	185.6	0.994
1 20	116.1	0.482	199.0	0.950	4 14	184.5	0.989	7 08	181.4	0.969
1 22	90.9	0.469	195.4	0.978	4 19	180.3	0.961	7 16	176.8	0.927
2 00	67.9	0.523	191.9	0.995	5 00	175.8	0.918	8 00	171.6	0.870
2 02	50.7	0.620	188.5	1.000	5 05	170.7	0.859	8 08	165.7	0.799
2 04	38.5	0.730	185.2	0.992	5 10	164.8	0.789	8 16	158.4	0.719
2 06	29.4	0.834	181.7	0.972	5 15	157.7	0.711	9 00	149.4	0.636
2 08	22.2	0.917	178.0	0.940	5 20	148.7	0.631	9 08	137.7	0.559
2 10	16.0	0.974	174.0	0.897	6 01	137.3	0.557	9 16	122.7	0.498
2 12	10.4	0.999	169.6	0.845	6 06	122.7	0.498	10 00	104.6	0.467
2 14	4.8	0.990	164.5	0.785	6 11	105.3	0.468	10 08	85.7	0.476
2 16			158.5	0.720	6 16	87.0	0.474	10 16	68.7	0.520
2 18			151.3	0.653	6 21	70.3	0.514	11 00	55.1	0.590
2 20			142.5	0.587	7 02	56.8	0.579	11 08	44.6	0.671
2 22			131.7	0.530	7 07	46.2	0.656	11 16	36.4	0.753
3 00			118.6	0.488	7 12	37.9	0.736	12 00	29.8	0.829
3 02			103.6	0.467	7 17	31.2	0.812	12 08	24.2	0.895
3 04			88.2	0.472	7 22	25.6	0.879	12 16	19.3	0.947
3 06			73.9	0.503	8 03	20.7	0.933	13 00	14.8	0.982
3 08			61.6	0.552	8 08	16.3	0.972	13 08	10.6	0.999
3 10			51.7	0.613	8 13	12.2	0.994	13 16	6.5	0.996
3 12			43.6	0.680	8 18	8.2	1.000			
3 14			36.9	0.747						
3 16			31.4	0.810						
3 18			26.6	0.867						
3 20			22.3	0.916						
3 22			18.5	0.954						
4 00			14.9	0.981						
4 02			11.5	0.997						
4 04			8.1	1.000						

Position angle of satellite is $p_1 + p_2$ Apparent distance of satellite is $F \frac{a}{\Delta}$

UNIVERSAL TIME OF GREATEST NORTHERN ELONGATION

ARIEL

Jan.	d h 0 06.8 2 19.3 5 07.8 7 20.3 10 08.8	Feb. 19 16.6 22 05.1 24 17.6 27 06.1 29 18.6	Apr. 10 02.5 12 15.0 15 03.5 17 16.0 20 04.5	May 30 12.4 June 2 00.9 4 13.4 7 01.9 9 14.4	Sept. 25 23.3 28 11.8 Oct. 1 00.3 3 12.7 6 01.2	Nov. 15 08.9 17 21.4 20 09.9 22 22.4 25 10.9
	12 21.3 15 09.8 17 22.3 20 10.7 22 23.2	Mar. 3 07.1 5 19.6 8 08.1 10 20.6 13 09.1	22 17.0 25 05.5 27 18.0 30 06.5	12 02.9 14 15.4 17 03.9 19 16.3 22 04.8	8 13.7 11 02.2 13 14.6 16 03.1 18 15.6	27 23.3 30 11.8 Dec. 3 00.3 5 12.8 8 01.2
	25 11.7 28 00.2 30 12.7	15 21.6 18 10.1 20 22.6	5 07.5 7 20.0 10 08.5	24 17.3 27 05.8 29 18.3	21 04.1 23 16.6 26 05.1	10 13.7 13 02.2 15 14.7
Feb.	2 01.2 4 13.7	23 11.1 25 23.6	12 21.0 15 09.5	July 2 06.8 4 19.3	28 17.5 31 06.0	18 03.2 20 15.7
	7 02.2 9 14.7 12 03.2 14 15.7 17 04.2	28 12.1 31 00.6 Apr. 2 13.1 5 01.5 7 14.0	17 22.0 20 10.4 22 22.9 25 11.4 27 23.9	7 07.8 Sept. 23 10.8	Nov. 2 18.5 5 07.0 7 19.5 10 08.0 12 20.4	23 04.2 25 16.7 28 05.1 30 17.6 33 06.1

UMBRIEL

Jan.	d h 1 15.9 5 19.4 9 22.8 14 02.3 18 05.8 22 09.2	Feb. 20 09.5 24 13.0 28 16.4 Mar. 3 19.9 7 23.4 12 02.8	Apr. 10 03.2 14 06.6 18 10.1 22 13.6 26 17.0 30 20.5	May 29 20.8 June 3 00.2 7 03.7 11 07.1 15 10.6 19 14.1	Oct. 1 04.3 5 07.7 9 11.2 13 14.6 17 18.1 21 21.5	Nov. 19 21.7 24 01.1 28 04.6 Dec. 2 08.0 6 11.4 10 14.9
	26 12.7 30 16.1	16 06.3 20 09.8	May 5 00.0 9 03.4	23 17.5 27 21.0	26 01.0 30 04.4	14 18.4 18 21.8
Feb.	3 19.6 7 23.1 12 02.6 16 06.0	24 13.3 28 16.7 Apr. 1 20.2 5 23.7	13 06.9 17 10.4 21 13.8 25 17.3	July 2 00.4 6 03.9 Sept. 27 00.8	Nov. 3 07.9 7 11.3 11 14.8 15 18.2	23 01.3 27 04.7 31 08.2 35 11.6

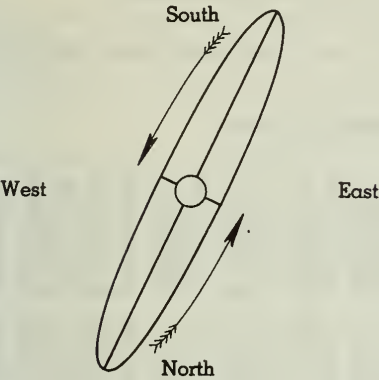
TITANIA

Jan.	d h - 2 17.9 7 10.9 16 03.8 24 20.8	Feb. 19 23.7 28 16.7 Mar. 8 09.7 17 02.7	Apr. 12 05.6 20 22.5 29 15.5 May 8 08.5	June 3 11.3 12 04.2 20 21.1 29 14.0	Oct. 3 07.8 12 00.7 20 17.6 29 10.5	Nov. 24 13.2 Dec. 3 06.1 11 23.1 20 16.0 29 09.0 38 01.9
Feb.	2 13.8 11 06.8	25 19.6 Apr. 3 12.6	17 01.4 25 18.4	Sept. 24 14.9	Nov. 7 03.4 15 20.3	

OBERON

Jan.	d h - 6 12.7 7 23.9 21 11.0	Feb. 17 09.5 Mar. 1 20.7 15 07.9	Apr. 11 06.3 24 17.4 May 8 04.6	June 4 02.7 17 13.8 July 1 00.8	Oct. 3 05.8 16 16.8 30 03.8	Nov. 26 01.9 Dec. 9 13.0 23 00.1 36 11.3
Feb.	3 22.3	28 19.1	21 15.6	.. ..	Nov. 12 14.8	

APPARENT ORBIT OF TRITON AT DATE OF OPPOSITION, APRIL 28



NAME	SIDEREAL PERIOD
I Triton	5 ^d 21 ^h .044
II Nereid	359 ^d

TRITON

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Jan. - 1 03.3 5 00.3 10 21.3 16 18.4 22 15.4 28 12.4	Feb. 21 00.5 26 21.6 Mar. 3 18.6 9 15.7 15 12.7 21 09.8 27 06.9	Apr. 13 22.1 19 19.2 25 16.3 May 1 13.4 7 10.5 13 07.5 19 04.6 25 01.7 30 22.8	June 5 19.9 11 17.0 17 14.1 23 11.1 29 08.2 July 5 05.3 11 02.3 16 23.4 22 20.5	July 28 17.5 Aug. 3 14.6 9 11.6 15 08.6 21 05.7 27 02.7 Sept. 1 23.7 7 20.7 13 17.7	Sept. 19 14.7 25 11.7 Dec. 10 20.5 16 17.5 22 14.5 28 11.5 34 08.5
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APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)	<i>p</i> ₁	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	<i>p</i> ₁	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	<i>p</i> ₁	$\frac{a}{\Delta}$	Date (0 ^h U.T.)	<i>p</i> ₁	$\frac{a}{\Delta}$
Jan.-13 7 27	-0.5 0.7 0.8	15.8 16.0 16.1	Mar. 27 Apr. 16 May 6	-0.6 0.4 -0.2	16.6 16.7 16.7	July 5 25 Aug. 14	+0.2 0.2 +0.1	16.4 16.2 16.0	......	......	......
Feb. 16 Mar. 7	0.8 -0.7	16.3 16.5	26 June 15	0.0 +0.1	16.6 16.5	Sept. 3 23	0.0 -0.2	15.9 15.7	Dec. 12 32	-1.1 -1.3	15.8 15.9

Time from Eastern Elongation	<i>p</i> ₁	<i>F</i>	Time from Eastern Elongation	<i>p</i> ₁	<i>F</i>	Time from Eastern Elongation	<i>p</i> ₁	<i>F</i>	Time from Eastern Elongation	<i>p</i> ₁	<i>F</i>
d h	°		d h	°		d h	°		d h	°	
0 00	155.0	1.000	1 12	256.0	0.173	3 00	335.6	0.998	4 12	95.3	0.196
0 03	156.3	0.991	1 15	289.7	0.236	3 03	337.0	0.981	4 15	119.3	0.283
0 06	157.7	0.966	1 18	306 3	0.337	3 06	338.4	0.947	4 18	131.1	0.391
0 09	159.1	0.923	1 21	314.9	0.448	3 09	339.9	0.896	4 21	137.7	0.502
0 12	160.7	0.865	2 00	320.1	0.556	3 12	341.6	0.831	5 00	142.0	0.607
0 15	162.6	0.792	2 03	323.6	0.658	3 15	343.7	0.751	5 03	145.0	0.705
0 18	165.0	0.706	2 06	326.3	0.750	3 18	346.3	0.659	5 06	147.3	0.791
0 21	168.0	0.609	2 09	328.3	0.830	3 21	349.9	0.558	5 09	149.2	0.864
1 00	172.2	0.503	2 12	330.1	0.895	4 00	355.0	0.449	5 12	150.9	0.922
1 03	178.8	0.393	2 15	331.6	0.946	4 03	3 6	0.339	5 15	152.3	0.965
1 06	190.4	0.285	2 18	333.0	0.980	4 06	19.9	0.237	5 18	153.7	0.991
1 09	214.2	0.197	2 21	334.3	0.998	4 09	53.4	0.173	5 21	155.0	1.000

Position angle of satellite is *p*₁+*p*₂ Apparent distance of satellite is $F\frac{a}{\Delta}$

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
SUNRISE (UPPER LIMB)														
Jan.	0	5 59	6 16	6 35	6 55	7 08	7 22	7 38	7 59	8 08	8 19	8 32	8 46	9 03
	5	6 01	6 18	6 36	6 57	7 09	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 01
	10	6 04	6 20	6 37	6 57	7 09	7 22	7 37	7 56	8 05	8 16	8 27	8 40	8 56
	15	6 06	6 21	6 38	6 57	7 08	7 20	7 35	7 53	8 02	8 12	8 22	8 35	8 49
	20	6 07	6 22	6 38	6 56	7 06	7 18	7 32	7 49	7 57	8 06	8 16	8 28	8 41
Feb.	25	6 09	6 23	6 37	6 54	7 04	7 15	7 28	7 44	7 51	8 00	8 09	8 19	8 31
	30	6 10	6 23	6 37	6 52	7 01	7 11	7 23	7 38	7 45	7 52	8 00	8 10	8 21
	4	6 10	6 22	6 35	6 49	6 57	7 07	7 18	7 31	7 37	7 44	7 51	7 59	8 09
	9	6 11	6 21	6 33	6 46	6 53	7 01	7 11	7 23	7 28	7 34	7 41	7 48	7 57
	14	6 11	6 20	6 30	6 42	6 48	6 56	7 04	7 14	7 19	7 24	7 30	7 36	7 44
Mar.	19	6 11	6 19	6 27	6 37	6 43	6 49	6 56	7 05	7 09	7 13	7 18	7 24	7 30
	24	6 10	6 17	6 24	6 32	6 37	6 42	6 48	6 56	6 59	7 02	7 06	7 11	7 16
	29	6 09	6 15	6 21	6 27	6 31	6 35	6 40	6 46	6 48	6 51	6 54	6 58	7 01
	5	6 08	6 12	6 17	6 22	6 24	6 27	6 31	6 35	6 37	6 39	6 41	6 44	6 47
	10	6 07	6 10	6 13	6 16	6 18	6 20	6 22	6 25	6 26	6 27	6 28	6 30	6 32
Apr.	15	6 06	6 07	6 09	6 10	6 11	6 12	6 13	6 14	6 14	6 15	6 16	6 16	6 17
	20	6 04	6 04	6 04	6 04	6 04	6 04	6 03	6 03	6 03	6 03	6 02	6 02	6 02
	25	6 03	6 01	6 00	5 58	5 57	5 56	5 54	5 52	5 51	5 50	5 49	5 48	5 47
	30	6 01	5 58	5 55	5 52	5 50	5 47	5 45	5 41	5 40	5 38	5 36	5 34	5 31
	4	6 00	5 56	5 51	5 46	5 43	5 39	5 35	5 30	5 28	5 26	5 23	5 20	5 16

BEGINNING OF ASTRONOMICAL TWILIGHT

Jan.	0	4 44	5 01	5 15	5 30	5 36	5 43	5 51	6 00	6 02	6 06	6 10	6 14	6 18
	5	4 46	5 03	5 18	5 31	5 38	5 45	5 52	6 00	6 03	6 07	6 10	6 14	6 18
	10	4 49	5 05	5 19	5 32	5 39	5 45	5 53	5 59	6 02	6 05	6 09	6 12	6 16
	15	4 51	5 07	5 20	5 33	5 39	5 45	5 51	5 58	6 01	6 04	6 06	6 09	6 13
	20	4 54	5 08	5 21	5 32	5 38	5 44	5 49	5 55	5 57	5 59	6 03	6 05	6 08
Feb.	25	4 55	5 10	5 21	5 32	5 37	5 42	5 46	5 51	5 54	5 55	5 58	5 59	6 01
	30	4 58	5 10	5 21	5 31	5 35	5 39	5 42	5 46	5 48	5 50	5 51	5 53	5 54
	4	4 58	5 10	5 20	5 28	5 31	5 35	5 38	5 41	5 41	5 43	5 44	5 45	5 46
	9	5 00	5 10	5 18	5 25	5 28	5 31	5 32	5 34	5 35	5 35	5 35	5 36	5 35
	14	5 00	5 10	5 17	5 22	5 24	5 26	5 27	5 27	5 27	5 26	5 26	5 26	5 24
Mar.	19	5 01	5 08	5 14	5 18	5 19	5 19	5 20	5 19	5 18	5 17	5 16	5 14	5 13
	24	5 00	5 07	5 11	5 13	5 14	5 14	5 12	5 09	5 08	5 07	5 05	5 02	5 00
	29	5 00	5 05	5 08	5 08	5 08	5 06	5 04	5 00	4 58	4 55	4 53	4 49	4 45
	5	4 59	5 03	5 05	5 04	5 02	4 59	4 55	4 49	4 46	4 44	4 40	4 36	4 30
	10	4 58	5 00	5 01	4 58	4 55	4 51	4 46	4 39	4 35	4 31	4 26	4 21	4 14
Apr.	15	4 57	4 58	4 56	4 51	4 48	4 43	4 37	4 27	4 23	4 17	4 12	4 05	3 57
	20	4 56	4 55	4 52	4 45	4 40	4 34	4 26	4 15	4 10	4 04	3 57	3 49	3 39
	25	4 54	4 52	4 48	4 39	4 33	4 26	4 16	4 03	3 57	3 50	3 41	3 31	3 20
	30	4 53	4 49	4 42	4 32	4 25	4 17	4 05	3 50	3 43	3 34	3 25	3 13	2 58
	4	4 51	4 46	4 38	4 26	4 17	4 08	3 54	3 36	3 28	3 18	3 06	2 53	2 36

SOUTHERN LATITUDES (July to October)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	July 1	6 11	16 22	27 Aug.	1 Aug.	7 12	17 22	28 Sept.	2 Sept.	7 12	17 22	27 Oct.	3 Oct.	8
Use	Jan. 0	5 10	15 20	25 Jan.	30 Feb.	4 9	14 19	24 Feb.	29 Mar.	5 10	15 20	25 Mar.	30 Apr.	4
Apply	+1	0 -2	-3 -4	-6	-7	-8	-9 -10 -11 -12	-13	-14	-14	-14 -15 -15	-15	-15	-15

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
------	------	----	------	------	------	------	------	------	------	------	------	------	------	------

SUNSET (UPPER LIMB)

		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	18	07	17	49	17	31	17	10	16	58	16	44	16	27	16	07
	5	18	09	17	52	17	34	17	14	17	02	16	48	16	32	16	12
	10	18	11	17	55	17	37	17	18	17	06	16	53	16	37	16	18
	15	18	13	17	57	17	41	17	22	17	11	16	58	16	43	16	25
	20	18	15	18	00	17	44	17	26	17	16	17	04	16	50	16	33
Feb.	25	18	16	18	02	17	47	17	30	17	21	17	10	16	57	16	41
	30	18	17	18	04	17	50	17	35	17	26	17	16	17	04	16	49
	4	18	17	18	06	17	53	17	39	17	31	17	22	17	11	16	58
	9	18	18	18	07	17	56	17	43	17	36	17	28	17	18	17	06
	14	18	18	18	08	17	58	17	47	17	41	17	34	17	25	17	15
Mar.	19	18	17	18	09	18	01	17	51	17	46	17	39	17	32	17	24
	24	18	17	18	10	18	03	17	55	17	50	17	45	17	39	17	32
	29	18	16	18	11	18	05	17	58	17	55	17	51	17	46	17	41
	5	18	15	18	11	18	07	18	02	17	59	17	56	17	53	17	49
	10	18	14	18	11	18	08	18	05	18	04	18	02	17	59	17	57
Apr.	15	18	12	18	11	18	10	18	08	18	07	18	06	18	05	18	05
	20	18	11	18	11	18	11	18	12	18	12	18	13	18	13	18	13
	25	18	09	18	11	18	12	18	15	18	16	18	17	18	19	18	21
	30	18	08	18	11	18	14	18	18	18	20	18	22	18	25	18	29
	4	18	06	18	11	18	15	18	21	18	24	18	27	18	32	18	37

END OF ASTRONOMICAL TWILIGHT

		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	19	22	19	04	18	50	18	35	18	29	18	21	18	13	18	06
	5	19	24	19	07	18	52	18	39	18	32	18	25	18	18	18	10
	10	19	25	19	10	18	55	18	43	18	36	18	29	18	22	18	15
	15	19	27	19	11	18	58	18	46	18	40	18	34	18	27	18	21
	20	19	28	19	14	19	01	18	49	18	44	18	39	18	33	18	28
Feb.	25	19	29	19	15	19	03	18	53	18	49	18	44	18	39	18	35
	30	19	29	19	17	19	06	18	57	18	53	18	49	18	45	18	41
	4	19	29	19	18	19	08	19	01	18	57	18	55	18	52	18	49
	9	19	29	19	19	19	11	19	04	19	02	19	00	18	58	18	56
	14	19	29	19	19	19	12	19	08	19	06	19	05	19	04	19	04
Mar.	19	19	27	19	20	19	15	19	11	19	11	19	10	19	10	19	12
	24	19	27	19	20	19	17	19	15	19	14	19	15	19	17	19	20
	29	19	25	19	21	19	18	19	18	19	19	19	21	19	24	19	29
	5	19	24	19	21	19	20	19	21	19	23	19	26	19	31	19	37
	10	19	23	19	21	19	21	19	24	19	28	19	32	19	37	19	45
Apr.	15	19	21	19	21	19	23	19	28	19	32	19	37	19	44	19	54
	20	19	20	19	21	19	24	19	31	19	37	19	43	19	51	20	03
	25	19	18	19	21	19	26	19	35	19	41	19	49	19	59	20	12
	30	19	17	19	21	19	28	19	39	19	46	19	55	20	06	20	23
	4	19	15	19	21	19	29	19	42	19	51	20	01	20	15	20	33

SOUTHERN LATITUDES (July to October)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	July	1	6	11	16	22	27	Aug.	1	Aug.	7	12	17	22	28	Sept.	2	Sept.	7	12	17	22	27	Oct.	3	Oct.	8
Use	Jan.	0	5	10	15	20	25	Jan.	30	Feb.	4	9	14	19	24	Feb.	29	Mar.	5	10	15	20	25	Mar.	30	Apr.	4
Apply		+1	0	-2	-3	-4	-6		-7		-8	-9	-10	-11	-12		-13		-14	-14	-14	-15	-15		-15		-15

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		SUNRISE (UPPER LIMB)												
Apr.	4	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	9	6 00	5 56	5 51	5 46	5 43	5 39	5 35	5 30	5 28	5 26	5 23	5 20	5 16
	14	5 58	5 53	5 47	5 40	5 36	5 32	5 26	5 20	5 17	5 14	5 10	5 06	5 01
	19	5 57	5 50	5 43	5 34	5 29	5 24	5 17	5 09	5 06	5 02	4 57	4 52	4 46
	24	5 56	5 48	5 39	5 29	5 23	5 16	5 09	4 59	4 55	4 50	4 45	4 39	4 32
May	29	5 55	5 45	5 35	5 24	5 17	5 09	5 00	4 49	4 44	4 39	4 32	4 25	4 17
	4	5 54	5 43	5 32	5 19	5 11	5 03	4 52	4 40	4 34	4 28	4 21	4 13	4 03
	9	5 53	5 42	5 29	5 15	5 06	4 57	4 45	4 31	4 25	4 18	4 09	4 00	3 50
	14	5 53	5 40	5 27	5 11	5 01	4 51	4 38	4 23	4 16	4 08	3 59	3 49	3 37
	19	5 53	5 39	5 24	5 07	4 57	4 46	4 32	4 16	4 08	3 59	3 49	3 38	3 25
June	24	5 53	5 38	5 23	5 04	4 54	4 41	4 27	4 09	4 00	3 51	3 40	3 28	3 13
	29	5 53	5 38	5 21	5 02	4 51	4 38	4 22	4 03	3 54	3 44	3 32	3 19	3 03
	3	5 54	5 38	5 20	5 00	4 48	4 35	4 18	3 58	3 48	3 38	3 25	3 11	2 54
	8	5 54	5 38	5 20	4 59	4 47	4 32	4 15	3 54	3 44	3 33	3 20	3 05	2 46
	13	5 55	5 38	5 20	4 58	4 46	4 31	4 14	3 52	3 41	3 29	3 16	3 00	2 41
July	18	5 56	5 39	5 20	4 58	4 45	4 30	4 13	3 50	3 40	3 27	3 13	2 57	2 37
	23	5 57	5 40	5 21	4 59	4 46	4 31	4 13	3 50	3 39	3 27	3 13	2 56	2 35
	28	5 58	5 41	5 22	5 00	4 47	4 32	4 14	3 51	3 40	3 28	3 13	2 57	2 36
	3	6 00	5 42	5 23	5 01	4 48	4 33	4 15	3 53	3 42	3 30	3 16	2 59	2 39
	8	6 00	5 43	5 25	5 03	4 50	4 36	4 18	3 56	3 46	3 34	3 20	3 04	2 44
		6 01	5 45	5 26	5 05	4 53	4 39	4 21	4 00	3 50	3 38	3 25	3 10	2 51

BEGINNING OF ASTRONOMICAL TWILIGHT

Apr.	4	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	9	4 51	4 46	4 38	4 26	4 17	4 08	3 54	3 36	3 28	3 18	3 06	2 53	2 36
	14	4 50	4 42	4 33	4 19	4 09	3 58	3 43	3 24	3 13	3 02	2 48	2 32	2 10
	19	4 47	4 40	4 29	4 12	4 02	3 49	3 32	3 09	2 58	2 45	2 29	2 08	1 39
	24	4 46	4 36	4 24	4 06	3 54	3 40	3 20	2 55	2 42	2 26	2 06	1 39	0 58
May	29	4 44	4 34	4 19	4 00	3 47	3 31	3 10	2 40	2 25	2 06	1 42	1 03	
	4	4 43	4 31	4 16	3 54	3 39	3 22	2 58	2 25	2 07	1 44	1 11		
	9	4 42	4 29	4 12	3 47	3 32	3 13	2 48	2 10	1 49	1 19	0 15		
	14	4 41	4 26	4 08	3 42	3 25	3 05	2 37	1 54	1 28	0 44			
	19	4 40	4 24	4 05	3 38	3 20	2 57	2 25	1 37	1 02				
June	24	4 40	4 23	4 02	3 33	3 14	2 49	2 16	1 18	0 26				
	29	4 39	4 22	3 59	3 29	3 09	2 43	2 06	0 58		When no times are given, twilight lasts all night.			
	3	4 40	4 22	3 58	3 26	3 06	2 38	1 58	0 32					
	8	4 40	4 21	3 57	3 24	3 02	2 33	1 51						
	13	4 40	4 21	3 56	3 22	3 00	2 30	1 45						
July	18	4 41	4 22	3 56	3 22	2 58	2 27	1 41						
	23	4 42	4 22	3 57	3 22	2 59	2 28	1 40						
	28	4 43	4 22	3 57	3 22	2 59	2 28	1 40						
	3	4 44	4 24	3 59	3 25	3 01	2 30	1 43						
	8	4 45	4 26	4 00	3 27	3 04	2 33	1 47						
	13	4 46	4 27	4 03	3 30	3 07	2 38	1 54						
	18													

SOUTHERN LATITUDES (October to January)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Oct.	8	12	17	22	27	Nov.	1	Nov.	6	11	16	20	25	30	Dec.	5	9	14	19	23	28	Jan.	2	Jan.	7
Use	Apr.	4	9	14	19	24	Apr.	29	May	4	9	14	19	24	29	June	3	8	13	18	23	28	July	3	July	8
Apply		-15	-15	-15	-15	-14		-14		-13	-12	-12	-11	-10	-9		-7	-7	-5	-4	-3	-2		0		+1

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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SUNSET (UPPER LIMB)

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	4	18 06	18 11	18 15	18 21	18 24	18 27	18 32	18 37	18 39	18 42	18 44	18 48	18 51
	9	18 05	18 11	18 17	18 24	18 28	18 32	18 38	18 44	18 47	18 51	18 55	18 59	19 03
	14	18 04	18 10	18 18	18 27	18 32	18 37	18 44	18 52	18 56	19 00	19 05	19 10	19 16
	19	18 02	18 11	18 20	18 30	18 36	18 42	18 50	19 00	19 05	19 09	19 15	19 21	19 28
	24	18 01	18 11	18 21	18 33	18 40	18 48	18 57	19 08	19 13	19 19	19 25	19 32	19 41
May	29	18 01	18 11	18 23	18 36	18 44	18 53	19 03	19 16	19 22	19 28	19 35	19 44	19 53
	4	18 00	18 12	18 25	18 39	18 48	18 58	19 09	19 23	19 30	19 37	19 45	19 55	20 05
	9	18 00	18 13	18 27	18 42	18 52	19 03	19 15	19 31	19 38	19 46	19 55	20 06	20 18
	14	18 00	18 14	18 29	18 46	18 56	19 07	19 21	19 38	19 46	19 55	20 05	20 16	20 30
	19	18 00	18 15	18 31	18 49	19 00	19 12	19 27	19 45	19 53	20 03	20 14	20 27	20 41
June	24	18 00	18 16	18 33	18 52	19 03	19 16	19 32	19 51	20 00	20 11	20 23	20 36	20 52
	29	18 01	18 17	18 35	18 55	19 07	19 20	19 37	19 57	20 07	20 18	20 30	20 45	21 02
	3	18 02	18 18	18 37	18 58	19 10	19 24	19 41	20 02	20 12	20 24	20 37	20 52	21 11
	8	18 03	18 20	18 38	19 00	19 13	19 27	19 45	20 07	20 17	20 29	20 43	20 59	21 18
	13	18 04	18 21	18 40	19 02	19 15	19 30	19 48	20 10	20 21	20 33	20 47	21 03	21 24
July	18	18 05	18 22	18 41	19 03	19 16	19 31	19 49	20 12	20 23	20 35	20 50	21 06	21 27
	23	18 06	18 23	18 42	19 04	19 17	19 33	19 51	20 13	20 24	20 36	20 51	21 07	21 28
	28	18 07	18 24	18 43	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 50	21 07	21 27
	3	18 08	18 25	18 44	19 05	19 18	19 32	19 50	20 12	20 22	20 34	20 48	21 04	21 23
	8	18 09	18 25	18 43	19 04	19 17	19 31	19 48	20 09	20 19	20 31	20 44	20 59	21 18

END OF ASTRONOMICAL TWILIGHT

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	4	19 15	19 21	19 29	19 42	19 51	20 01	20 15	20 33	20 42	20 52	21 04	21 19	21 36
	9	19 14	19 22	19 32	19 46	19 56	20 07	20 23	20 43	20 53	21 06	21 21	21 38	22 00
	14	19 14	19 21	19 33	19 50	20 01	20 14	20 31	20 55	21 07	21 21	21 38	22 00	22 30
	19	19 12	19 23	19 36	19 54	20 06	20 21	20 40	21 07	21 21	21 37	21 58	22 26	23 15
	24	19 12	19 23	19 38	19 58	20 12	20 29	20 50	21 20	21 36	21 56	22 22	23 04	
May	29	19 12	19 24	19 41	20 03	20 17	20 36	20 59	21 34	21 53	22 16	22 53		
	4	19 12	19 26	19 43	20 07	20 23	20 43	21 09	21 48	22 10	22 42			
	9	19 12	19 27	19 46	20 11	20 29	20 51	21 19	22 04	22 31	23 20			
	14	19 13	19 29	19 49	20 17	20 35	20 57	21 29	22 21	22 57				
	19	19 13	19 30	19 52	20 21	20 40	21 05	21 40	22 39	23 43				
June	24	19 14	19 32	19 55	20 25	20 45	21 11	21 50	23 00					
	29	19 15	19 34	19 58	20 29	20 51	21 18	21 59	23 30					
	3	19 17	19 35	20 00	20 33	20 55	21 24	22 07						
	8	19 18	19 37	20 02	20 36	20 59	21 29	22 15						
	13	19 19	19 39	20 04	20 38	21 02	21 33	22 20						
July	18	19 20	19 40	20 05	20 40	21 03	21 34	22 22						
	23	19 21	19 41	20 06	20 41	21 04	21 36	22 24						
	28	19 22	19 42	20 07	20 41	21 05	21 36	22 23						
	3	19 23	19 42	20 08	20 41	21 04	21 34	22 19						
	8	19 24	19 42	20 06	20 39	21 02	21 31	22 14						

SOUTHERN LATITUDES (October to January)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Oct.	8	12	17	22	27	Nov.	1	Nov.	6	11	16	20	25	30	Dec.	5	9	14	19	23	28	Jan.	2	Jan.	7
Use	Apr.	4	9	14	19	24	Apr.	29	May	4	9	14	19	24	29	June	3	8	13	18	23	28	July	3	July	8
Apply		-15	-15	-15	-15	-14		-14		-13	-12	-12	-11	-10	-9		-7	-7	-5	-4	-3	-2		0		+1

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°

SUNRISE (UPPER LIMB)

		h	m	h	m	h	m	h	m	h	m	h	m	h	m
July	3	6	00	5	43	5	25	5	03	4	50	4	36	4	18
	8	6	01	5	45	5	26	5	05	4	53	4	39	4	21
	13	6	02	5	46	5	28	5	08	4	56	4	42	4	26
	18	6	03	5	47	5	30	5	11	4	59	4	46	4	30
	23	6	03	5	48	5	32	5	13	5	03	4	50	4	35
Aug.	28	6	03	5	49	5	34	5	16	5	06	4	54	4	41
	2	6	03	5	50	5	36	5	19	5	10	4	59	4	46
	7	6	02	5	50	5	37	5	22	5	14	5	04	4	52
	12	6	02	5	51	5	39	5	25	5	18	5	08	4	58
	17	6	01	5	51	5	40	5	28	5	21	5	13	5	04
Sept.	22	5	59	5	51	5	42	5	31	5	25	5	18	5	10
	27	5	58	5	51	5	43	5	34	5	29	5	16	5	07
	1	5	57	5	51	5	44	5	37	5	33	5	28	5	22
	6	5	55	5	50	5	45	5	40	5	36	5	32	5	28
	11	5	53	5	50	5	46	5	42	5	40	5	37	5	34
Oct.	16	5	52	5	50	5	48	5	45	5	43	5	42	5	40
	21	5	50	5	49	5	49	5	48	5	47	5	46	5	45
	26	5	48	5	49	5	50	5	50	5	51	5	52	5	52
	1	5	46	5	49	5	51	5	53	5	55	5	56	6	00
	6	5	45	5	48	5	52	5	56	5	59	6	01	6	04

BEGINNING OF ASTRONOMICAL TWILIGHT

		h	m	h	m	h	m	h	m	h	m	h	m	h	m
July	3	4	45	4	26	4	00	3	27	3	04	2	33	1	47
	8	4	46	4	27	4	03	3	30	3	07	2	38	1	54
	13	4	48	4	29	4	05	3	33	3	11	2	43	2	02
	18	4	48	4	31	4	08	3	37	3	16	2	49	2	11
	23	4	50	4	32	4	11	3	41	3	21	2	56	2	20
Aug.	28	4	50	4	34	4	13	3	45	3	26	3	03	2	30
	2	4	51	4	36	4	15	3	50	3	32	3	10	2	40
	7	4	50	4	36	4	18	3	54	3	38	3	17	2	50
	12	4	51	4	38	4	21	3	58	3	43	3	25	3	00
	17	4	50	4	39	4	23	4	02	3	49	3	31	3	09
Sept.	22	4	50	4	39	4	26	4	07	3	53	3	38	3	18
	27	4	48	4	40	4	27	4	11	3	59	3	45	3	27
	1	4	48	4	40	4	29	4	14	4	04	3	51	3	35
	6	4	46	4	41	4	31	4	17	4	08	3	57	3	43
	11	4	45	4	40	4	32	4	21	4	13	4	03	3	50
Oct.	16	4	43	4	40	4	33	4	24	4	18	4	09	3	58
	21	4	41	4	39	4	35	4	27	4	21	4	14	4	05
	26	4	39	4	39	4	36	4	30	4	26	4	20	4	13
	1	4	38	4	39	4	38	4	34	4	30	4	25	4	19
	6	4	36	4	38	4	39	4	37	4	34	4	30	4	26

SOUTHERN LATITUDES (January to April)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Jan.	2	7	12	16	21	26	Jan.	31	Feb.	4	9	14	19	23	Feb.	28	Mar.	4	9	14	19	24	Mar.	28	Apr.	2
Use	July	3	8	13	18	23	28	Aug.	2	Aug.	7	12	17	22	27	Sept.	1	Sept.	6	11	16	21	26	Oct.	1	Oct.	6
Apply		0	+1	+2	+3	+5	+6		+7		+8	+9	+10	+11	+12		+13		+13	+14	+14	+15	+15		+15		+16

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date		Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
SUNSET (UPPER LIMB)															
July	3		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	8		18 08	18 25	18 44	19 05	19 18	19 32	19 50	20 12	20 22	20 34	20 48	21 04	21 23
	13		18 09	18 25	18 43	19 04	19 17	19 31	19 48	20 09	20 19	20 31	20 44	20 59	21 18
	18		18 09	18 26	18 43	19 03	19 15	19 29	19 45	20 06	20 15	20 26	20 39	20 53	21 10
	23		18 10	18 25	18 42	19 01	19 13	19 26	19 42	20 01	20 10	20 20	20 32	20 46	21 02
Aug.	28		18 10	18 25	18 41	18 59	19 10	19 22	19 37	19 55	20 04	20 13	20 24	20 37	20 51
	2		18 10	18 24	18 39	18 56	19 06	19 18	19 32	19 48	19 56	20 05	20 15	20 27	20 40
	7		18 10	18 23	18 36	18 53	19 02	19 13	19 25	19 41	19 48	19 56	20 06	20 16	20 28
	12		18 09	18 21	18 34	18 48	18 57	19 07	19 19	19 33	19 39	19 47	19 55	20 04	20 15
	17		18 08	18 19	18 31	18 44	18 52	19 01	19 11	19 24	19 30	19 36	19 44	19 52	20 01
Sept.	22		18 07	18 17	18 27	18 39	18 46	18 54	19 03	19 15	19 20	19 26	19 32	19 39	19 47
	27		18 06	18 14	18 24	18 34	18 40	18 47	18 55	19 05	19 09	19 14	19 20	19 26	19 33
	1		18 05	18 12	18 19	18 28	18 33	18 39	18 46	18 54	18 58	19 03	19 07	19 13	19 18
	6		18 03	18 09	18 15	18 23	18 27	18 32	18 37	18 44	18 47	18 51	18 54	18 59	19 04
	11		18 02	18 06	18 11	18 17	18 20	18 24	18 28	18 33	18 36	18 38	18 41	18 45	18 49
Oct.	16		18 00	18 03	18 06	18 10	18 13	18 15	18 19	18 22	18 24	18 26	18 28	18 31	18 33
	21		17 58	18 00	18 02	18 04	18 06	18 07	18 09	18 11	18 13	18 14	18 15	18 17	18 18
	26		17 56	17 57	17 57	17 58	17 58	17 59	18 00	18 00	18 01	18 01	18 02	18 02	18 03
	1		17 55	17 54	17 53	17 52	17 51	17 51	17 50	17 49	17 49	17 49	17 49	17 48	17 48
	6		17 53	17 51	17 48	17 46	17 44	17 42	17 41	17 38	17 38	17 36	17 35	17 34	17 33
			17 51	17 48	17 44	17 40	17 37	17 34	17 31	17 28	17 26	17 24	17 22	17 20	17 18

END OF ASTRONOMICAL TWILIGHT

July	3	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	8	19 23	19 42	20 08	20 41	21 04	21 34	22 19							
	13	19 24	19 42	20 06	20 39	21 02	21 31	22 14							
	18	19 23	19 43	20 06	20 37	20 59	21 27	22 07	23 37						
	23	19 24	19 41	20 04	20 34	20 55	21 21	21 59	23 10						
Aug.	28	19 23	19 41	20 02	20 31	20 50	21 15	21 50	22 49	23 50	When no times are given, twilight lasts all night.				
	2	19 23	19 39	19 59	20 26	20 45	21 08	21 40	22 30	23 06					
	7	19 22	19 37	19 55	20 22	20 39	21 01	21 29	22 14	22 41	23 29				
	12	19 21	19 35	19 53	20 16	20 32	20 52	21 19	21 58	22 19	22 51				
	17	19 19	19 32	19 49	20 11	20 25	20 44	21 07	21 42	22 01	22 24	23 02			
Sept.	22	19 18	19 29	19 44	20 04	20 18	20 35	20 56	21 27	21 43	22 03	22 29	23 11		
	27	19 16	19 26	19 40	19 58	20 10	20 26	20 45	21 12	21 25	21 42	22 03	22 31	23 22	
	1	19 15	19 23	19 34	19 51	20 02	20 16	20 33	20 57	21 09	21 24	21 40	22 03	22 32	
	6	19 12	19 20	19 30	19 45	19 55	20 07	20 22	20 43	20 53	21 06	21 20	21 38	22 01	
	11	19 11	19 16	19 25	19 38	19 47	19 58	20 11	20 29	20 39	20 48	21 01	21 16	21 35	
Oct.	16	19 09	19 13	19 20	19 31	19 39	19 48	20 00	20 16	20 24	20 33	20 43	20 56	21 10	
	21	19 07	19 10	19 15	19 24	19 31	19 39	19 49	20 03	20 10	20 18	20 26	20 37	20 49	
	26	19 05	19 07	19 10	19 18	19 23	19 30	19 39	19 50	19 56	20 02	20 11	20 19	20 30	
	1	19 04	19 04	19 06	19 12	19 15	19 21	19 28	19 38	19 43	19 49	19 55	20 02	20 11	
	6	19 02	19 01	19 01	19 05	19 08	19 12	19 19	19 26	19 31	19 35	19 40	19 46	19 54	
		19 00	18 58	18 57	18 59	19 01	19 04	19 08	19 15	19 18	19 22	19 26	19 31	19 37	

SOUTHERN LATITUDES (January to April)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Jan.	2	7	12	16	21	26	Jan.	31	Feb.	4	9	14	19	23	Feb.	28	Mar.	4	9	14	19	24	Mar.	28	Apr.	2
Use	July	3	8	13	18	23	28	Aug.	2	Aug.	7	12	17	22	27	Sept.	1	Sept.	6	11	16	21	26	Oct.	1	Oct.	6
Apply		0	+1	+2	+3	+5	+6		+7		+8	+9	+10	+11	+12		+13		+13	+14	+14	+15	+15		+15		+16

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
SUNRISE (UPPER LIMB)														
Oct.	1	h m 5 46	h m 5 49	h m 5 51	h m 5 53	h m 5 55	h m 5 56	h m 5 58	h m 6 00	h m 6 01	h m 6 02	h m 6 03	h m 6 04	h m 6 05
	6	5 45	5 48	5 52	5 56	5 59	6 01	6 04	6 08	6 09	6 11	6 13	6 15	6 17
	11	5 43	5 45	5 53	5 59	6 03	6 06	6 10	6 15	6 18	6 20	6 23	6 26	6 29
	16	5 42	5 49	5 55	6 02	6 07	6 11	6 17	6 23	6 26	6 30	6 33	6 37	6 42
Nov.	21	5 41	5 49	5 57	6 06	6 11	6 17	6 23	6 31	6 35	6 39	6 44	6 49	6 54
	26	5 41	5 49	5 59	6 09	6 15	6 22	6 30	6 40	6 44	6 49	6 54	7 00	7 07
	31	5 40	5 50	6 01	6 13	6 20	6 28	6 37	6 48	6 53	6 59	7 05	7 12	7 20
	5	5 40	5 51	6 03	6 17	6 25	6 34	6 44	6 56	7 02	7 08	7 16	7 24	7 32
Dec.	10	5 40	5 53	6 06	6 21	6 30	6 39	6 51	7 05	7 11	7 18	7 26	7 35	7 45
	15	5 41	5 55	6 09	6 25	6 34	6 45	6 58	7 13	7 20	7 28	7 37	7 47	7 58
	20	5 42	5 57	6 12	6 29	6 39	6 51	7 04	7 21	7 29	7 37	7 47	7 58	8 10
	25	5 43	5 59	6 15	6 33	6 44	6 56	7 11	7 28	7 37	7 46	7 56	8 08	8 22
	30	5 45	6 01	6 18	6 38	6 49	7 02	7 17	7 36	7 44	7 54	8 05	8 18	8 33
	5	5 47	6 04	6 21	6 41	6 53	7 07	7 22	7 42	7 51	8 01	8 13	8 27	8 43
	10	5 49	6 06	6 24	6 45	6 57	7 11	7 27	7 47	7 57	8 08	8 20	8 34	8 51
	15	5 52	6 09	6 27	6 48	7 01	7 15	7 31	7 52	8 02	8 13	8 25	8 40	8 57
	20	5 54	6 11	6 30	6 51	7 04	7 18	7 35	7 55	8 05	8 16	8 29	8 44	9 01
	25	5 56	6 14	6 32	6 54	7 06	7 20	7 37	7 58	8 07	8 19	8 31	8 46	9 04
	30	5 59	6 16	6 34	6 55	7 08	7 22	7 38	7 59	8 08	8 19	8 32	8 46	9 03
	35	6 01	6 18	6 36	6 57	7 09	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 01

BEGINNING OF ASTRONOMICAL TWILIGHT

Oct.	1	h m 4 38	h m 4 39	h m 4 38	h m 4 34	h m 4 30	h m 4 25	h m 4 19	h m 4 10	h m 4 06	h m 4 01	h m 3 56	h m 3 49	h m 3 42
	6	4 36	4 38	4 39	4 37	4 34	4 30	4 26	4 19	4 15	4 11	4 07	4 02	3 55
	11	4 35	4 38	4 40	4 40	4 38	4 35	4 32	4 27	4 24	4 20	4 17	4 13	4 08
	16	4 32	4 39	4 41	4 42	4 42	4 40	4 38	4 35	4 33	4 30	4 27	4 24	4 20
Nov.	21	4 31	4 38	4 42	4 45	4 46	4 46	4 44	4 42	4 40	4 39	4 38	4 35	4 33
	26	4 31	4 38	4 44	4 49	4 49	4 50	4 51	4 50	4 49	4 48	4 47	4 46	4 44
	31	4 29	4 39	4 46	4 51	4 54	4 56	4 57	4 57	4 57	4 57	4 57	4 56	4 55
	5	4 29	4 39	4 48	4 55	4 58	5 00	5 03	5 05	5 05	5 05	5 05	5 06	5 06
Dec.	10	4 28	4 40	4 49	4 58	5 02	5 05	5 08	5 12	5 12	5 13	5 15	5 16	5 17
	15	4 28	4 41	4 52	5 02	5 06	5 10	5 14	5 18	5 20	5 22	5 24	5 24	5 27
	20	4 29	4 42	4 54	5 05	5 10	5 16	5 20	5 25	5 27	5 29	5 32	5 34	5 36
	25	4 29	4 44	4 57	5 09	5 14	5 20	5 25	5 32	5 34	5 36	5 40	5 41	5 45
	30	4 31	4 47	4 59	5 13	5 19	5 25	5 31	5 37	5 40	5 44	5 47	5 49	5 53
	5	4 33	4 48	5 03	5 16	5 22	5 29	5 36	5 43	5 46	5 49	5 53	5 56	6 00
	10	4 34	4 51	5 06	5 19	5 26	5 33	5 40	5 47	5 51	5 55	5 58	6 02	6 05
	15	4 36	4 53	5 08	5 23	5 29	5 37	5 44	5 52	5 55	5 59	6 02	6 07	6 11
	20	4 38	4 56	5 10	5 25	5 32	5 39	5 47	5 55	5 59	6 02	6 06	6 10	6 15
	25	4 41	4 58	5 13	5 27	5 35	5 42	5 50	5 57	6 01	6 04	6 09	6 13	6 17
	30	4 43	5 01	5 15	5 30	5 36	5 43	5 51	6 00	6 02	6 06	6 10	6 14	6 18
	35	4 46	5 03	5 18	5 31	5 38	5 45	5 53	6 00	6 03	6 07	6 10	6 14	6 18

SOUTHERN LATITUDES (April to July)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Apr.	2	7	13	18	23	28	May	3	8	13	19	24	29	June	3	9	14	19	25	30	July	5
Use	Oct.	6	11	16	21	26	31	Nov.	5	10	15	20	25	30	Dec.	5	10	15	20	25	30	Dec.	35
Apply		+16	+15	+15	+15	+14	+14		+13	+13	+12	+11	+10	+9		+8	+6	+5	+4	+2	+1		0

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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SUNSET (UPPER LIMB)

		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Oct.	1	17	53	17	51	17	48	17	46	17	44	17	42	17	41	17	38
	6	17	51	17	48	17	44	17	40	17	37	17	34	17	31	17	28
	11	17	50	17	45	17	40	17	34	17	30	17	27	17	22	17	17
	16	17	49	17	43	17	36	17	28	17	24	17	19	17	14	17	07
	21	17	48	17	40	17	32	17	23	17	18	17	12	17	05	16	57
Nov.	26	17	47	17	38	17	29	17	18	17	12	17	05	16	57	16	48
	31	17	47	17	37	17	26	17	14	17	07	16	59	16	50	16	39
	5	17	47	17	36	17	24	17	10	17	02	16	53	16	43	16	30
	10	17	48	17	35	17	22	17	07	16	58	16	48	16	37	16	23
	15	17	48	17	35	17	20	17	04	16	55	16	44	16	31	16	16
Dec.	20	17	49	17	35	17	19	17	02	16	52	16	40	16	27	16	10
	25	17	51	17	35	17	19	17	01	16	50	16	38	16	23	16	05
	30	17	52	17	36	17	19	17	00	16	49	16	36	16	20	16	02
	5	17	54	17	38	17	20	17	00	16	48	16	35	16	19	15	59
	10	17	57	17	40	17	21	17	01	16	49	16	35	16	18	15	58
	15	17	59	17	42	17	23	17	02	16	50	16	36	16	19	15	58
	20	18	01	17	44	17	25	17	04	16	52	16	38	16	21	16	00
	25	18	04	17	47	17	28	17	07	16	54	16	40	16	23	16	03
	30	18	06	17	49	17	31	17	10	16	58	16	44	16	27	16	07
	35	18	09	17	52	17	34	17	14	17	02	16	48	16	32	16	12

END OF ASTRONOMICAL TWILIGHT

		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Oct.	1	19	02	19	01	19	01	19	05	19	08	19	12	19	19	19	26
	6	19	00	18	58	18	57	18	59	19	01	19	04	19	08	19	15
	11	18	59	18	55	18	53	18	53	18	54	18	57	18	59	19	04
	16	18	59	18	53	18	50	18	48	18	48	18	49	18	52	18	54
	21	18	58	18	51	18	46	18	43	18	42	18	42	18	43	18	45
Nov.	26	18	57	18	49	18	43	18	38	18	37	18	36	18	35	18	36
	31	18	58	18	49	18	41	18	35	18	33	18	31	18	29	18	28
	5	18	58	18	48	18	39	18	31	18	28	18	25	18	23	18	20
	10	19	00	18	48	18	38	18	29	18	25	18	21	18	18	18	15
	15	19	01	18	48	18	36	18	27	18	22	18	18	18	13	18	09
Dec.	20	19	02	18	49	18	36	18	25	18	20	18	15	18	10	18	04
	25	19	05	18	49	18	36	18	25	18	19	18	13	18	07	18	01
	30	19	06	18	51	18	37	18	24	18	18	18	12	18	05	17	59
	5	19	09	18	53	18	38	18	25	18	18	18	12	18	05	17	57
	10	19	12	18	55	18	39	18	26	18	19	18	12	18	04	17	57
	15	19	14	18	57	18	42	18	27	18	21	18	14	18	06	17	57
	20	19	16	18	59	18	44	18	30	18	23	18	16	18	08	18	00
	25	19	19	19	02	18	47	18	32	18	25	18	18	18	10	18	02
	30	19	21	19	04	18	50	18	35	18	29	18	21	18	13	18	06
	35	19	24	19	07	18	52	18	39	18	32	18	25	18	18	18	10

SOUTHERN LATITUDES (April to July)

For dates on first line, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Apr.	2	7	13	18	23	28	May	3	8	13	19	24	29	June	3	9	14	19	25	30	July	5
Use	Oct.	6	11	16	21	26	31	Nov.	5	10	15	20	25	30	Dec.	5	10	15	20	25	30	Dec.	35
Apply		+16	+15	+15	+15	+14	+14		+13	+13	+12	+11	+10	+9		+8	+6	+5	+4	+2	+1		0

Date		Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
			^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m
Jan.	0		7 30	7 43	7 55	8 10	8 18	8 28	8 39	8 53	9 00	9 07	9 14	9 23	9 33
	1		8 28	8 38	8 48	9 00	9 06	9 14	9 23	9 34	9 39	9 44	9 50	9 57	10 04
	2		9 22	9 28	9 36	9 44	9 49	9 54	10 00	10 08	10 11	10 15	10 19	10 24	10 29
	3		10 12	10 16	10 20	10 24	10 27	10 30	10 33	10 37	10 39	10 41	10 44	10 46	10 49
	4		11 00	11 00	11 01	11 02	11 02	11 03	11 04	11 04	11 05	11 05	11 06	11 06	11 06
	5		11 45	11 43	11 41	11 38	11 36	11 35	11 32	11 30	11 29	11 28	11 26	11 25	11 23
	6		12 30	12 25	12 20	12 14	12 10	12 06	12 01	11 56	11 53	11 51	11 48	11 44	11 40
	7		13 15	13 07	12 59	12 49	12 44	12 38	12 31	12 23	12 19	12 15	12 10	12 05	11 59
	8		14 00	13 50	13 39	13 27	13 20	13 12	13 03	12 52	12 47	12 41	12 35	12 28	12 20
	9		14 45	14 33	14 21	14 06	13 58	13 49	13 38	13 24	13 18	13 11	13 04	12 55	12 45
	10		15 31	15 18	15 04	14 48	14 39	14 28	14 16	14 01	13 54	13 46	13 37	13 28	13 16
	11		16 19	16 05	15 50	15 33	15 23	15 12	14 59	14 43	14 36	14 27	14 18	14 07	13 55
	12		17 06	16 53	16 38	16 21	16 11	16 00	15 47	15 31	15 23	15 15	15 05	14 55	14 42
	13		17 54	17 41	17 27	17 11	17 02	16 51	16 39	16 24	16 17	16 09	16 00	15 50	15 38
14		18 42	18 31	18 18	18 04	17 55	17 46	17 35	17 22	17 15	17 08	17 00	16 52	16 42	
15		19 30	19 20	19 10	18 58	18 51	18 43	18 34	18 23	18 18	18 12	18 06	17 59	17 51	
16		20 17	20 10	20 02	19 53	19 48	19 42	19 35	19 27	19 23	19 19	19 14	19 09	19 03	
17		21 03	20 59	20 54	20 49	20 46	20 42	20 38	20 33	20 30	20 28	20 25	20 22	20 19	
18		21 50	21 49	21 47	21 45	21 44	21 43	21 42	21 40	21 39	21 39	21 38	21 37	21 36	
19		22 38	22 39	22 41	22 43	22 44	22 46	22 47	22 49	22 50	22 51	22 52	22 53	22 54	
20		23 27	23 32	23 37	23 42	23 46	23 50	23 54		0 00	0 02	0 05	0 08	0 11	0 15
21															
22		0 18	0 26	0 34	0 44	0 49	0 55	1 03	1 12	1 16	1 20	1 25	1 31	1 37	
23		1 12	1 22	1 34	1 46	1 54	2 02	2 12	2 24	2 30	2 36	2 43	2 51	3 00	
24		2 09	2 21	2 35	2 50	2 59	3 10	3 22	3 36	3 43	3 51	4 00	4 09	4 20	
25		3 08	3 22	3 37	3 54	4 04	4 15	4 28	4 44	4 52	5 01	5 10	5 21	5 33	
26		4 09	4 23	4 38	4 55	5 05	5 17	5 30	5 46	5 54	6 03	6 12	6 23	6 35	

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Jan.	0	h m 19 58	h m 19 47	h m 19 35	h m 19 22	h m 19 14	h m 19 05	h m 18 55	h m 18 42	h m 18 36	h m 18 29	h m 18 22	h m 18 14	h m 18 04
	1	20 54	20 46	20 37	20 26	20 20	20 14	20 06	19 56	19 52	19 47	19 41	19 35	19 28
	2	21 46	21 41	21 35	21 28	21 25	21 20	21 15	21 09	21 06	21 03	21 00	20 56	20 52
	3	22 35	22 33	22 30	22 28	22 26	22 24	22 22	22 20	22 18	22 17	22 16	22 14	22 12
	4	23 22	23 23	23 23	23 24	23 25	23 26	23 26	23 27	23 28	23 28	23 29	23 29	23 30
	5
	6	0 07	0 11	0 15	0 19	0 22	0 25	0 29	0 33	0 35	0 37	0 39	0 42	0 45
	7	0 52	0 58	1 05	1 13	1 18	1 23	1 29	1 36	1 40	1 43	1 47	1 52	1 57
	8	1 36	1 45	1 55	2 06	2 12	2 19	2 28	2 38	2 42	2 48	2 53	3 00	3 07
	9	2 21	2 32	2 44	2 58	3 05	3 14	3 25	3 37	3 43	3 50	3 57	4 05	4 15
	10	3 07	3 20	3 33	3 49	3 58	4 08	4 20	4 34	4 41	4 49	4 57	5 07	5 18
	11	3 54	4 08	4 22	4 39	4 48	5 00	5 12	5 28	5 36	5 44	5 53	6 04	6 16
	12	4 42	4 56	5 10	5 27	5 37	5 49	6 02	6 18	6 26	6 34	6 43	6 54	7 07
	13	5 30	5 43	5 58	6 14	6 24	6 35	6 47	7 03	7 10	7 18	7 27	7 38	7 49
	14	6 18	6 30	6 43	6 58	7 07	7 17	7 29	7 43	7 49	7 57	8 05	8 14	8 24
	15	7 05	7 16	7 27	7 40	7 48	7 56	8 06	8 18	8 24	8 30	8 37	8 44	8 53
	16	7 52	8 01	8 10	8 20	8 26	8 33	8 41	8 50	8 54	8 59	9 04	9 10	9 16
	17	8 39	8 45	8 51	8 58	9 03	9 07	9 12	9 19	9 22	9 25	9 28	9 32	9 37
	18	9 26	9 29	9 32	9 36	9 38	9 40	9 43	9 46	9 47	9 49	9 51	9 53	9 55
	19	10 13	10 13	10 13	10 13	10 13	10 13	10 13	10 12	10 12	10 12	10 12	10 12	10 12
Feb.	20	11 01	10 58	10 55	10 51	10 49	10 46	10 43	10 40	10 38	10 36	10 34	10 32	10 30
	21	11 51	11 45	11 38	11 31	11 26	11 21	11 16	11 09	11 06	11 02	10 59	10 54	10 50
	22	12 43	12 34	12 25	12 14	12 07	12 00	11 52	11 42	11 37	11 32	11 26	11 20	11 13
	23	13 39	13 27	13 15	13 01	12 53	12 44	12 33	12 20	12 14	12 07	12 00	11 51	11 42
	24	14 37	14 24	14 10	13 53	13 44	13 33	13 21	13 06	12 58	12 50	12 42	12 31	12 20
	25	15 37	15 23	15 08	14 51	14 41	14 30	14 16	14 00	13 52	13 44	13 34	13 23	13 10
	26	16 38	16 25	16 10	15 54	15 44	15 32	15 19	15 03	14 56	14 47	14 38	14 27	14 15
	27	17 39	17 26	17 13	16 58	16 50	16 40	16 28	16 14	16 07	15 59	15 51	15 42	15 31
	28	18 37	18 27	18 16	18 04	17 57	17 49	17 39	17 28	17 23	17 17	17 10	17 03	16 54
	29	19 31	19 24	19 17	19 08	19 03	18 58	18 51	18 43	18 39	18 35	18 30	18 25	18 20
	30	20 23	20 19	20 15	20 10	20 08	20 04	20 01	19 56	19 54	19 52	19 49	19 47	19 44
	31	21 13	21 12	21 11	21 10	21 10	21 09	21 08	21 07	21 07	21 07	21 06	21 05	21 05
	1	22 00	22 02	22 05	22 08	22 09	22 11	22 13	22 16	22 17	22 18	22 20	22 21	22 23
	2	22 46	22 51	22 57	23 03	23 07	23 11	23 16	23 22	23 24	23 27	23 31	23 34	23 38
	3	23 31	23 39	23 48	23 57
	4	0 03	0 09	0 16	0 25	0 29	0 34	0 39	0 44	0 51
	5	0 17	0 27	0 38	0 50	0 57	1 05	1 15	1 26	1 32	1 38	1 44	1 52	2 00
	6	1 02	1 14	1 27	1 42	1 50	2 00	2 11	2 25	2 31	2 38	2 46	2 55	3 05
	7	1 49	2 02	2 16	2 32	2 42	2 52	3 05	3 20	3 27	3 35	3 44	3 54	4 06
	8	2 36	2 50	3 04	3 21	3 31	3 42	3 55	4 11	4 19	4 27	4 37	4 47	5 00
	9	3 24	3 38	3 52	4 09	4 19	4 30	4 43	4 58	5 06	5 14	5 23	5 34	5 46
	10	4 12	4 25	4 38	4 54	5 03	5 14	5 26	5 40	5 47	5 55	6 03	6 13	6 24
	11	5 00	5 11	5 24	5 37	5 45	5 55	6 05	6 18	6 24	6 30	6 38	6 46	6 55
	12	5 48	5 57	6 07	6 19	6 25	6 33	6 41	6 51	6 56	7 01	7 07	7 14	7 21
	13	6 36	6 42	6 50	6 58	7 03	7 08	7 14	7 22	7 25	7 29	7 33	7 38	7 43
	14	7 23	7 27	7 31	7 36	7 39	7 42	7 46	7 50	7 52	7 54	7 57	7 59	8 02
	15	8 11	8 12	8 13	8 14	8 15	8 16	8 16	8 17	8 18	8 18	8 19	8 20	8 20
	16	8 59	8 57	8 55	8 52	8 51	8 49	8 47	8 45	8 44	8 43	8 41	8 40	8 38

LOCAL MEAN TIME OF MOONRISE (UPON
MERIDIAN OF GREENWICH)

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°
		h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	20 36	20 36	20 37	20 38	20 38	20 39	20 39	20 40	20 41
	16	21 25	21 29	21 33	21 37	21 40	21 43	21 46	21 50	21 53
	17	22 15	22 22	22 29	22 37	22 42	22 48	22 54	23 02	23 08
	18	23 08	23 17	23 27	23 39	23 46	23 54	...	...	...
	19	...	...	...	...	...	...	0 03	0 14	0 26
	20	0 02	0 14	0 27	0 41	0 50	0 59	1 11	1 24	1 37
	21	0 59	1 12	1 27	1 43	1 52	2 03	2 16	2 32	2 45
	22	1 57	2 11	2 26	2 43	2 53	3 05	3 18	3 34	3 47
	23	2 56	3 10	3 24	3 41	3 50	4 01	4 14	4 29	4 42
	24	3 54	4 06	4 19	4 34	4 42	4 52	5 03	5 17	5 30
	25	4 51	5 00	5 11	5 23	5 30	5 37	5 46	5 57	6 08
	26	5 45	5 52	5 59	6 08	6 13	6 18	6 24	6 32	6 41
	27	6 36	6 40	6 45	6 49	6 52	6 55	6 59	7 03	7 07
	28	7 26	7 27	7 28	7 28	7 29	7 30	7 30	7 31	7 32
	29	8 14	8 12	8 09	8 06	8 05	8 03	8 01	7 58	7 55
Mar.	1	9 01	8 56	8 50	8 44	8 40	8 36	8 31	8 26	8 21
	2	9 47	9 39	9 31	9 21	9 16	9 10	9 03	8 54	8 46
	3	10 33	10 23	10 12	10 00	9 53	9 45	9 36	9 24	9 14
	4	11 20	11 08	10 55	10 41	10 32	10 23	10 12	9 58	9 47
	5	12 06	11 53	11 39	11 23	11 14	11 04	10 51	10 36	10 21
	6	12 54	12 40	12 25	12 09	11 59	11 48	11 35	11 19	11 03
	7	13 41	13 28	13 13	12 56	12 47	12 36	12 23	12 07	11 50
	8	14 29	14 16	14 03	13 47	13 38	13 28	13 15	13 01	12 44
	9	15 17	15 06	14 54	14 40	14 32	14 23	14 12	13 59	13 45
	10	16 05	15 56	15 46	15 34	15 28	15 20	15 12	15 01	14 48
	11	16 53	16 46	16 39	16 31	16 26	16 21	16 14	16 07	16 00
	12	17 41	17 37	17 33	17 29	17 26	17 23	17 19	17 15	17 11
	13	18 30	18 29	18 28	18 27	18 27	18 27	18 26	18 25	18 24
	14	19 20	19 22	19 25	19 28	19 30	19 32	19 34	19 37	19 40
	15	20 11	20 16	20 22	20 29	20 34	20 38	20 44	20 50	20 56
	16	21 04	21 12	21 21	21 32	21 38	21 45	21 53	22 03	22 11
	17	21 58	22 09	22 21	22 35	22 43	22 52	23 03	23 16	23 28
	18	22 55	23 08	23 21	23 37	23 46	23 57	...	...	...
	19	23 52	...	...	...	...	...	0 09	0 25	0 40
	20	...	0 06	0 21	0 38	0 48	0 59	1 12	1 28	1 43
	21	0 50	1 04	1 18	1 35	1 45	1 56	2 09	2 25	2 40
	22	1 47	2 00	2 13	2 28	2 37	2 47	2 59	3 14	3 28
	23	2 42	2 53	3 04	3 17	3 25	3 33	3 43	3 55	4 07
	24	3 36	3 44	3 53	4 02	4 08	4 15	4 22	4 31	4 40
	25	4 27	4 32	4 38	4 44	4 48	4 52	4 57	5 02	5 07
	26	5 17	5 19	5 21	5 24	5 25	5 27	5 29	5 31	5 33

MOONSET, NORTHERN LATITUDES, 1960

LOCAL MEAN TIME OF MOONSET (UPPER LIMB) MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	
Feb.	15	8 11	8 12	8 13	8 14	8 15	8 16	8 16	8 17	8 18	8 18	
	16	8 59	8 57	8 55	8 52	8 51	8 49	8 47	8 45	8 44	8 43	
	17	9 49	9 43	9 38	9 32	9 28	9 24	9 19	9 14	9 11	9 08	
	18	10 40	10 32	10 23	10 13	10 08	10 01	9 54	9 45	9 41	9 36	
	19	11 33	11 23	11 12	10 58	10 51	10 43	10 33	10 21	10 15	10 09	1
	20	12 29	12 17	12 03	11 48	11 39	11 29	11 17	11 02	10 56	10 48	1
	21	13 27	13 13	12 58	12 42	12 32	12 21	12 08	11 52	11 44	11 36	1
	22	14 26	14 12	13 57	13 40	13 30	13 19	13 05	12 49	12 42	12 33	1
	23	15 24	15 11	14 57	14 42	14 32	14 22	14 09	13 54	13 47	13 39	1
	24	16 21	16 10	15 59	15 45	15 37	15 28	15 18	15 05	14 59	14 52	1
	25	17 17	17 08	16 59	16 49	16 43	16 36	16 28	16 18	16 13	16 08	1
	26	18 10	18 04	17 58	17 52	17 48	17 43	17 38	17 32	17 29	17 26	1
	27	19 00	18 58	18 55	18 53	18 51	18 49	18 47	18 44	18 43	18 41	1
	28	19 49	19 50	19 51	19 52	19 52	19 53	19 54	19 54	19 55	19 55	1
	29	20 37	20 40	20 44	20 49	20 52	20 55	20 58	21 03	21 05	21 07	2
Mar.	1	21 23	21 30	21 37	21 45	21 50	21 55	22 01	22 09	22 12	22 16	2
	2	22 09	22 18	22 28	22 39	22 46	22 53	23 02	23 12	23 17	23 22	2
	3	22 56	23 07	23 19	23 32	23 40	23 49	...	...	...	...
	4	23 42	23 55	...	...	...	...	0 00	0 12	0 18	0 25	
	5	...	...	0 08	0 24	0 33	0 43	0 55	1 10	1 16	1 24	
	6	0 29	0 43	0 57	1 14	1 23	1 34	1 47	2 03	2 10	2 18	
	7	1 17	1 30	1 45	2 02	2 11	2 22	2 35	2 51	2 59	3 07	
	8	2 04	2 17	2 31	2 48	2 57	3 08	3 20	3 35	3 42	3 50	
	9	2 52	3 04	3 17	3 32	3 40	3 50	4 01	4 14	4 21	4 28	
	10	3 40	3 50	4 01	4 13	4 21	4 29	4 38	4 50	4 55	5 01	
	11	4 28	4 36	4 44	4 54	4 59	5 05	5 13	5 21	5 25	5 30	
	12	5 16	5 21	5 27	5 33	5 36	5 41	5 45	5 51	5 53	5 56	
	13	6 04	6 06	6 09	6 11	6 13	6 15	6 17	6 19	6 20	6 21	
	14	6 53	6 52	6 51	6 50	6 50	6 49	6 48	6 47	6 46	6 46	
	15	7 44	7 40	7 35	7 30	7 27	7 24	7 20	7 16	7 14	7 12	
	16	8 36	8 28	8 21	8 12	8 07	8 02	7 55	7 47	7 44	7 40	
	17	9 29	9 19	9 09	8 57	8 50	8 42	8 33	8 22	8 17	8 11	
	18	10 25	10 13	10 00	9 45	9 37	9 27	9 16	9 02	8 56	8 49	
	19	11 22	11 09	10 54	10 38	10 28	10 17	10 05	9 49	9 42	9 34	
	20	12 20	12 06	11 51	11 34	11 24	11 13	11 00	10 43	10 36	10 27	1
	21	13 17	13 04	12 50	12 34	12 24	12 13	12 01	11 45	11 38	11 30	1
	22	14 14	14 02	13 50	13 35	13 27	13 17	13 06	12 52	12 46	12 39	1
	23	15 08	14 59	14 49	14 37	14 30	14 22	14 13	14 02	13 57	13 52	1
	24	16 01	15 54	15 47	15 38	15 34	15 28	15 22	15 14	15 10	15 07	1
	25	16 51	16 47	16 43	16 39	16 36	16 33	16 30	16 25	16 24	16 21	1
	26	17 40	17 39	17 39	17 38	17 37	17 37	17 36	17 36	17 35	17 35	

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	1	9 59	9 46	9 33	9 17	9 08	8 58	8 46	8 32	8 25	8 18	8 09	8 00	7 49
	2	10 46	10 33	10 18	10 02	9 52	9 41	9 28	9 13	9 05	8 57	8 48	8 38	8 26
	3	11 34	11 20	11 05	10 48	10 39	10 28	10 14	9 58	9 51	9 43	9 33	9 23	9 11
	4	12 21	12 08	11 54	11 37	11 28	11 17	11 05	10 49	10 42	10 34	10 25	10 15	10 04
	5	13 08	12 56	12 44	12 29	12 20	12 10	11 59	11 45	11 39	11 32	11 23	11 14	11 04
	6	13 56	13 45	13 34	13 22	13 15	13 06	12 57	12 45	12 40	12 34	12 27	12 20	12 11
	7	14 43	14 35	14 27	14 17	14 11	14 05	13 58	13 49	13 45	13 40	13 35	13 29	13 23
	8	15 31	15 25	15 20	15 13	15 10	15 06	15 01	14 55	14 52	14 50	14 46	14 43	14 39
	9	16 19	16 17	16 15	16 12	16 10	16 09	16 07	16 04	16 03	16 02	16 01	16 00	15 58
	10	17 09	17 10	17 11	17 12	17 13	17 14	17 15	17 16	17 17	17 17	17 18	17 19	17 20
	11	18 00	18 04	18 09	18 14	18 18	18 21	18 25	18 30	18 32	18 35	18 38	18 41	18 44
	12	18 53	19 01	19 09	19 18	19 24	19 30	19 37	19 45	19 49	19 54	19 59	20 04	20 10
	13	19 49	19 59	20 10	20 23	20 30	20 39	20 49	21 01	21 06	21 12	21 19	21 27	21 36
	14	20 47	20 59	21 13	21 28	21 37	21 47	21 59	22 14	22 21	22 28	22 37	22 46	22 57
	15	21 46	22 00	22 14	22 31	22 41	22 52	23 05	23 21	23 29	23 37	23 47	23 57	...
	16	22 45	22 59	23 14	23 31	23 41	23 52	...	0 05	0 21	0 29	0 38	...	0 10
	17	23 43	23 56	...	...	...	...	0 05	0 21	0 29	0 38	0 47	0 58	1 10
	18	...	...	0 10	0 26	0 35	0 46	0 58	1 13	1 20	1 28	1 37	1 47	1 58
	19	0 39	0 50	1 02	1 16	1 24	1 33	1 44	1 57	2 02	2 09	2 16	2 25	2 34
	20	1 32	1 41	1 51	2 02	2 08	2 15	2 24	2 33	2 38	2 43	2 49	2 55	3 02
	21	2 23	2 30	2 36	2 44	2 48	2 53	2 59	3 05	3 09	3 12	3 16	3 20	3 25
	22	3 12	3 16	3 19	3 23	3 25	3 28	3 31	3 34	3 36	3 38	3 40	3 42	3 44
	23	4 00	4 00	4 00	4 00	4 01	4 01	4 01	4 01	4 01	4 01	4 02	4 02	4 02
	24	4 47	4 44	4 41	4 37	4 35	4 33	4 31	4 28	4 26	4 25	4 23	4 21	4 19
	25	5 33	5 27	5 21	5 14	5 10	5 06	5 00	4 54	4 52	4 49	4 45	4 41	4 37
	26	6 19	6 11	6 02	5 52	5 46	5 40	5 32	5 23	5 19	5 14	5 09	5 04	4 57
	27	7 06	6 55	6 44	6 31	6 24	6 15	6 06	5 54	5 48	5 43	5 36	5 29	5 20
	28	7 53	7 40	7 27	7 12	7 04	6 54	6 42	6 29	6 22	6 15	6 07	5 58	5 48
	29	8 40	8 26	8 12	7 56	7 46	7 36	7 23	7 08	7 00	6 52	6 43	6 33	6 22
	30	9 27	9 13	8 59	8 42	8 32	8 21	8 08	7 51	7 44	7 36	7 26	7 15	7 03
May	1	10 15	10 01	9 47	9 30	9 20	9 09	8 56	8 40	8 33	8 25	8 15	8 05	7 53
	2	11 02	10 49	10 35	10 20	10 11	10 01	9 48	9 34	9 27	9 19	9 11	9 01	8 50
	3	11 48	11 37	11 25	11 12	11 04	10 55	10 44	10 31	10 25	10 19	10 11	10 03	9 54
	4	12 35	12 26	12 16	12 05	11 58	11 51	11 43	11 32	11 28	11 22	11 16	11 10	11 02
	5	13 21	13 15	13 08	13 00	12 55	12 50	12 44	12 36	12 33	12 29	12 25	12 20	12 15
	6	14 08	14 04	14 01	13 56	13 53	13 51	13 47	13 43	13 41	13 39	13 37	13 34	13 32
	7	14 56	14 56	14 55	14 54	14 54	14 54	14 53	14 53	14 52	14 52	14 52	14 51	14 51
	8	15 46	15 49	15 52	15 55	15 57	15 59	16 02	16 05	16 06	16 08	16 10	16 12	16 14
	9	16 39	16 45	16 51	16 58	17 03	17 07	17 13	17 20	17 23	17 26	17 30	17 35	17 39
	10	17 34	17 43	17 52	18 04	18 10	18 17	18 26	18 36	18 41	18 47	18 53	18 59	19 07
	11	18 32	18 44	18 56	19 10	19 18	19 28	19 39	19 53	19 59	20 06	20 14	20 23	20 33
	12	19 32	19 46	20 00	20 16	20 26	20 37	20 50	21 05	21 13	21 21	21 30	21 41	21 53
	13	20 34	20 48	21 03	21 20	21 30	21 42	21 55	22 12	22 20	22 28	22 38	22 49	23 02
	14	21 34	21 48	22 03	22 19	22 29	22 40	22 53	23 09	23 16	23 25	23 34	23 44	23 56
	15	22 33	22 45	22 58	23 13	23 22	23 31	23 43	23 57	...	...	...	...	...
	16	23 29	23 39	23 49	...	...	...	...	...	0 03	0 10	0 18	0 27	0 37
	17	...	...	...	0 01	0 08	0 16	0 25	0 36	0 41	0 47	0 53	1 00	1 08
	18	0 21	0 28	0 36	0 45	0 50	0 55	1 02	1 10	1 14	1 18	1 22	1 27	1 33

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	1	22 22	22 35	22 49	23 05	23 15	23 25	23 38	23 53	...	...	...	...	...
	2	23 09	23 23	23 37	23 54	...	...	...	...	0 01	0 09	0 18	0 28	0 39
	3	23 56	...	...	...	0 04	0 15	0 28	0 44	0 52	1 00	1 09	1 20	1 32
	4	...	0 10	0 24	0 41	0 51	1 01	1 14	1 30	1 37	1 45	1 54	2 05	2 16
	5	0 44	0 56	1 10	1 25	1 34	1 44	1 56	2 11	2 17	2 25	2 33	2 42	2 53
	6	1 31	1 42	1 54	2 07	2 15	2 24	2 34	2 47	2 53	2 59	3 06	3 14	3 23
	7	2 18	2 27	2 37	2 48	2 54	3 01	3 10	3 20	3 24	3 29	3 35	3 41	3 48
	8	3 06	3 12	3 19	3 27	3 32	3 37	3 43	3 50	3 53	3 56	4 00	4 05	4 10
	9	3 54	3 57	4 01	4 06	4 08	4 11	4 14	4 18	4 20	4 22	4 24	4 26	4 29
	10	4 42	4 43	4 44	4 44	4 45	4 45	4 46	4 46	4 46	4 47	4 47	4 47	4 48
	11	5 33	5 30	5 27	5 24	5 22	5 20	5 18	5 15	5 13	5 12	5 10	5 08	5 06
	12	6 25	6 19	6 13	6 06	6 02	5 57	5 52	5 45	5 42	5 39	5 35	5 31	5 27
	13	7 20	7 11	7 01	6 51	6 44	6 37	6 29	6 19	6 15	6 10	6 04	5 58	5 51
	14	8 16	8 05	7 53	7 39	7 31	7 22	7 11	6 58	6 52	6 46	6 39	6 30	6 21
	15	9 15	9 02	8 48	8 32	8 22	8 12	7 59	7 44	7 37	7 29	7 21	7 11	6 59
	16	10 14	10 00	9 45	9 28	9 18	9 07	8 54	8 37	8 30	8 21	8 12	8 01	7 49
	17	11 13	10 59	10 45	10 28	10 18	10 07	9 54	9 38	9 30	9 22	9 13	9 02	8 50
	18	12 10	11 58	11 44	11 29	11 20	11 10	10 58	10 44	10 37	10 30	10 21	10 12	10 01
	19	13 05	12 54	12 43	12 31	12 23	12 15	12 05	11 53	11 48	11 42	11 35	11 27	11 18
	20	13 57	13 49	13 41	13 32	13 26	13 20	13 13	13 04	13 00	12 55	12 50	12 45	12 38
	21	14 47	14 42	14 37	14 31	14 28	14 24	14 20	14 14	14 12	14 09	14 06	14 02	13 59
	22	15 35	15 34	15 32	15 30	15 28	15 27	15 25	15 23	15 22	15 21	15 20	15 19	15 18
	23	16 22	16 24	16 25	16 27	16 28	16 29	16 30	16 31	16 32	16 33	16 34	16 34	16 36
	24	17 09	17 13	17 18	17 23	17 26	17 29	17 33	17 38	17 40	17 43	17 46	17 49	17 52
	25	17 55	18 02	18 10	18 18	18 23	18 29	18 36	18 44	18 47	18 51	18 56	19 01	19 07
	26	18 41	18 51	19 01	19 13	19 20	19 27	19 36	19 47	19 52	19 58	20 04	20 11	20 19
	27	19 28	19 40	19 52	20 06	20 14	20 24	20 35	20 48	20 54	21 01	21 08	21 17	21 27
	28	20 15	20 28	20 42	20 58	21 07	21 18	21 30	21 45	21 52	22 00	22 09	22 19	22 30
	29	21 03	21 16	21 31	21 48	21 58	22 09	22 22	22 38	22 45	22 54	23 03	23 14	23 26
	30	21 50	22 04	22 19	22 36	22 45	22 57	23 10	23 26	23 33	23 41	23 51	...	...
May	1	22 37	22 51	23 05	23 21	23 30	23 41	23 53	...	...	...	...	0 01	0 14
	2	23 24	23 36	23 49	...	...	...	...	0 08	0 15	0 23	0 32	0 42	0 53
	3	...	...	...	0 03	0 12	0 21	0 32	0 46	0 52	0 59	1 07	1 15	1 25
	4	0 11	0 21	0 32	0 44	0 51	0 59	1 08	1 19	1 24	1 30	1 36	1 44	1 52
	5	0 57	1 05	1 13	1 23	1 28	1 34	1 41	1 50	1 54	1 58	2 03	2 08	2 14
	6	1 44	1 49	1 54	2 00	2 04	2 08	2 13	2 18	2 21	2 23	2 26	2 30	2 33
	7	2 31	2 33	2 35	2 38	2 40	2 41	2 43	2 45	2 46	2 47	2 49	2 50	2 52
	8	3 20	3 19	3 18	3 17	3 16	3 15	3 14	3 13	3 12	3 12	3 11	3 10	3 10
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	10	5 04	4 57	4 49	4 40	4 35	4 29	4 22	4 14	4 10	4 06	4 01	3 56	3 51
	11	6 01	5 51	5 40	5 27	5 20	5 12	5 02	4 51	4 45	4 39	4 33	4 26	4 18
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	17	11 54	11 45	11 36	11 25	11 19	11 12	11 04	10 54	10 49	10 44	10 38	10 32	10 25
	18	12 45	12 39	12 33	12 28	12 22	12 17	12 12	12 05	12 02	11 59	11 55	11 51	11 46

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	18	1 11	1 15	1 20	1 25	1 28	1 31	1 35	1 40	1 42	1 44	1 47	1 50	1 53
	19	1 58	2 00	2 01	2 02	2 03	2 04	2 05	2 07	2 07	2 08	2 09	2 10	2 10
	20	2 45	2 43	2 41	2 39	2 38	2 36	2 34	2 33	2 32	2 31	2 30	2 29	2 27
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	31	10 30	10 20	10 09	9 57	9 50	9 42	9 32	9 21	9 15	9 09	9 03	8 55	8 47
June	1	11 16	11 08	11 00	10 50	10 45	10 39	10 31	10 23	10 19	10 14	10 09	10 04	9 57
	2	12 01	11 56	11 51	11 45	11 41	11 37	11 32	11 27	11 24	11 21	11 18	11 15	11 11
	3	12 48	12 45	12 43	12 41	12 39	12 37	12 36	12 33	12 32	12 31	12 30	12 28	12 27
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	8	17 13	17 25	17 39	17 54	18 03	18 14	18 26	18 41	18 48	18 55	19 04	19 14	19 25
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	14	23 07	23 12	23 18	23 25	23 29	23 33	23 38	23 44	23 47	23 50	23 53	23 57	...
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	16	0 01	0 04	0 06	0 07	0 10	0 12	0 13	0 15	0 16	0 18	0 19
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July	1	11 30	11 29	11 29	11 28	11 28	11 28	11 28	11 27	11 27	11 27	11 27	11 27	11 26
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	3	13 06	13 12	13 18	13 26	13 30	13 35	13 40	13 47	13 50	13 53	13 57	14 01	14 06
	4	13 59	14 08	14 17	14 28	14 34	14 42	14 50	15 00	15 05	15 10	15 16	15 22	15 30
	5	14 55	15 06	15 19	15 33	15 41	15 50	16 01	16 14	16 21	16 28	16 35	16 44	16 54
	6	15 54	16 08	16 22	16 38	16 48	16 59	17 11	17 27	17 35	17 43	17 52	18 02	18 14
	7	16 57	17 11	17 26	17 43	17 53	18 05	18 19	18 35	18 43	18 52	19 01	19 13	19 26
	8	18 00	18 13	18 28	18 45	18 55	19 06	19 19	19 35	19 43	19 51	20 00	20 11	20 23
	9	19 01	19 14	19 27	19 42	19 51	20 00	20 12	20 26	20 33	20 40	20 48	20 57	21 07
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	11	20 56	21 03	21 11	21 19	21 24	21 30	21 36	21 44	21 47	21 51	21 55	22 00	22 05
	12	21 49	21 53	21 57	22 01	22 04	22 07	22 10	22 15	22 16	22 18	22 21	22 23	22 26
	13	22 38	22 39	22 40	22 40	22 41	22 41	22 42	22 43	22 43	22 43	22 44	22 44	22 44
	14	23 26	23 23	23 21	23 18	23 16	23 14	23 12	23 09	23 08	23 07	23 05	23 04	23 02
	15	23 55	23 51	23 47	23 42	23 36	23 33	23 30	23 27	23 23	23 19
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	17	0 58	0 50	0 42	0 32	0 26	0 20	0 13	0 04	0 00
	18	1 44	1 34	1 23	1 10	1 03	0 55	0 45	0 34	0 29	0 23	0 16	0 09	0 01
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	30	11 02	11 06	11 11	11 17	11 20	11 24	11 29	11 34	11 36	11 39	11 42	11 45	11 49
Aug.	31	11 52	11 59	12 07	12 17	12 22	12 28	12 35	12 44	12 48	12 53	12 58	13 03	13 09
	1	12 44	12 54	13 05	13 18	13 25	13 34	13 44	13 55	14 01	14 07	14 14	14 22	14 30
	2	13 40	13 52	14 06	14 21	14 30	14 40	14 52	15 07	15 14	15 21	15 30	15 39	15 50
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	16	1 13	1 00	0 47	0 31	0 22	0 12	23 50	23 38
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)

MERIDIAN OF GREENWICH

Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Date														
July	1	h m 23 52	h m 23 51	h m 23 50	h m 23 48	h m 23 47	h m 23 46	h m 23 45	h m 23 44	h m 23 43	h m 23 43	h m 23 42	h m 23 41	h m 23 40
	2	23 43	23 43	23 42	23 41	23 58
	3	0 40	0 36	0 31	0 26	0 23	0 20	0 16	0 11	0 09	0 07	0 04	0 01
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	5	2 25	2 15	2 04	1 52	1 45	1 37	1 27	1 16	1 11	1 05	0 59	0 51	0 43
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	16	12 34	12 41	12 49	12 57	13 02	13 07	13 14	13 21	13 25	13 29	13 33	13 38	13 44
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	17	2 01	1 47	1 32	1 15	1 06	0 55	0 42	0 26	0 18	0 10	0 01		
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Sept.	31	13 28	13 42	13 57	14 14	14 24	14 35	14 49	15 05	15 13	15 21	15 31	15 42	15 55
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

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Sept.	31	0 57	0 43	0 29	0 12	0 02	23 53	23 42	23 29
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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Nov. 1	15 37	15 37	15 37	15 37	15 37	15 37	15 37	15 38	15 38	15 38	15 38	15 38	15 38	15 38
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	24	11 01	11 11	11 22	11 35	11 42	11 50	12 00	12 11	12 16	12 22	12 29	12 36	12 44
	25	11 55	12 02	12 10	12 19	12 24	12 30	12 37	12 45	12 49	12 53	12 58	13 03	13 09
	26	12 46	12 50	12 55	13 00	13 03	13 07	13 11	13 16	13 18	13 20	13 23	13 26	13 29
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	28	14 22	14 20	14 18	14 16	14 15	14 13	14 11	14 09	14 08	14 08	14 06	14 05	14 04
	29	15 09	15 04	14 59	14 53	14 50	14 46	14 41	14 36	14 34	14 31	14 28	14 25	14 21
	30	15 56	15 49	15 40	15 31	15 26	15 19	15 12	15 04	15 00	14 56	14 51	14 46	14 40
Dec.	1	16 44	16 34	16 23	16 10	16 03	15 55	15 46	15 34	15 29	15 23	15 17	15 10	15 02
	2	17 32	17 20	17 07	16 52	16 43	16 34	16 22	16 09	16 02	15 55	15 47	15 38	15 28
	3	18 20	18 07	17 52	17 36	17 26	17 15	17 03	16 47	16 40	16 32	16 23	16 12	16 01
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	6	20 44	20 31	20 17	20 00	19 51	19 40	19 28	19 12	19 05	18 57	18 48	18 38	18 26
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	10	23 45	23 40	23 35	23 29	23 25	23 22	23 17	23 12	23 10	23 07	23 04	23 01	22 57
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	12	0 29	0 27	0 25	0 23	0 22	0 20	0 19	0 17	0 16	0 15	0 14	0 12	0 11
	13	1 15	1 16	1 17	1 19	1 20	1 21	1 22	1 23	1 24	1 25	1 26	1 27	1 27
	14	2 03	2 07	2 12	2 17	2 20	2 24	2 28	2 33	2 35	2 38	2 40	2 44	2 47
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	19	6 48	7 02	7 18	7 35	7 46	7 58	8 11	8 28	8 36	8 45	8 55	9 06	9 19
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	29	15 29	15 17	15 05	14 51	14 43	14 34	14 23	14 10	14 04	13 58	13 50	13 42	13 33
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	31	17 05	16 51	16 36	16 18	16 08	15 57	15 44	15 28	15 20	15 11	15 02	14 51	14 39
	32	17 53	17 38	17 23	17 06	16 56	16 44	16 31	16 14	16 06	15 57	15 48	15 37	15 24

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov.	16	15 49	15 45	15 40	15 34	15 31	15 28	15 24	15 19	15 17	15 14	15 11	15 08	15 05
	17	16 41	16 33	16 25	16 16	16 11	16 05	15 58	15 49	15 45	15 41	15 37	15 31	15 26
	18	17 35	17 25	17 14	17 01	16 54	16 46	16 36	16 24	16 19	16 13	16 06	15 59	15 51
	19	18 33	18 20	18 07	17 51	17 42	17 32	17 20	17 06	16 59	16 52	16 43	16 34	16 23
	20	19 33	19 19	19 04	18 47	18 37	18 25	18 12	17 56	17 48	17 39	17 30	17 19	17 06
	21	20 34	20 19	20 04	19 47	19 36	19 25	19 11	18 54	18 46	18 37	18 27	18 16	18 03
	22	21 34	21 20	21 06	20 50	20 40	20 29	20 16	20 00	19 53	19 44	19 35	19 24	19 12
	23	22 32	22 20	22 08	21 54	21 45	21 36	21 25	21 11	21 05	20 58	20 50	20 41	20 31
	24	23 27	23 18	23 08	22 57	22 51	22 43	22 35	22 24	22 19	22 14	22 08	22 01	21 54
	25	...	...	...	23 59	23 55	23 50	23 44	23 37	23 34	23 31	23 27	23 22	23 18
	26	0 19	0 13	0 07	...	...	...	...	...	...	...	...	...	...
	27	1 09	1 06	1 03	1 00	0 58	0 55	0 53	0 49	0 48	0 46	0 44	0 42	0 40
	28	1 57	1 58	1 58	1 59	1 59	1 59	1 59	2 00	2 00	2 00	2 00	2 00	2 01
	29	2 45	2 48	2 52	2 56	2 59	3 02	3 05	3 09	3 10	3 12	3 14	3 17	3 20
	30	3 32	3 38	3 45	3 53	3 58	4 03	4 09	4 16	4 20	4 23	4 27	4 32	4 37
Dec.	1	4 19	4 28	4 38	4 49	4 56	5 03	5 12	5 22	5 27	5 32	5 38	5 45	5 52
	2	5 07	5 18	5 30	5 44	5 52	6 02	6 12	6 25	6 31	6 38	6 46	6 54	7 04
	3	5 55	6 08	6 22	6 38	6 47	6 58	7 10	7 25	7 32	7 40	7 49	7 59	8 11
	4	6 44	6 58	7 13	7 30	7 40	7 51	8 04	8 21	8 28	8 37	8 47	8 58	9 10
	5	7 32	7 46	8 01	8 19	8 29	8 40	8 54	9 11	9 18	9 27	9 37	9 48	10 00
	6	8 20	8 33	8 48	9 05	9 15	9 26	9 39	9 54	10 02	10 10	10 19	10 30	10 42
	7	9 07	9 19	9 32	9 48	9 57	10 07	10 18	10 33	10 39	10 47	10 55	11 04	11 15
	8	9 52	10 03	10 15	10 28	10 35	10 44	10 54	11 06	11 12	11 18	11 25	11 32	11 41
	9	10 37	10 46	10 55	11 05	11 11	11 18	11 26	11 36	11 40	11 45	11 50	11 56	12 03
	10	11 22	11 28	11 34	11 41	11 46	11 51	11 56	12 03	12 06	12 09	12 13	12 17	12 21
	11	12 06	12 09	12 13	12 17	12 19	12 21	12 24	12 28	12 29	12 31	12 33	12 35	12 38
	12	12 51	12 51	12 51	12 52	12 52	12 52	12 53	12 53	12 53	12 53	12 53	12 53	12 54
	13	13 37	13 35	13 32	13 28	13 26	13 24	13 22	13 18	13 17	13 16	13 14	13 12	13 10
	14	14 26	14 20	14 14	14 07	14 03	13 58	13 53	13 46	13 43	13 40	13 37	13 33	13 28
	15	15 18	15 09	15 00	14 49	14 43	14 36	14 28	14 18	14 13	14 08	14 03	13 57	13 50
	16	16 14	16 02	15 50	15 36	15 28	15 19	15 08	14 55	14 49	14 43	14 35	14 27	14 17
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	18	18 15	18 01	17 45	17 28	17 18	17 06	16 52	16 35	16 27	16 18	16 08	15 57	15 44
	19	19 18	19 04	18 49	18 31	18 21	18 09	17 56	17 39	17 31	17 23	17 13	17 02	16 49
	20	20 19	20 07	19 53	19 38	19 29	19 18	19 06	18 51	18 44	18 36	18 28	18 18	18 06
	21	21 18	21 08	20 57	20 44	20 37	20 28	20 19	20 07	20 01	19 55	19 48	19 40	19 31
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	24	23 56	23 55	23 54	23 53	23 52	23 52	23 51	23 50	23 49	23 49	23 48	23 48	23 47
	25
	26	0 44	0 46	0 48	0 51	0 53	0 55	0 57	1 00	1 01	1 02	1 04	1 05	1 07
	27	1 31	1 36	1 42	1 48	1 52	1 57	2 02	2 08	2 11	2 14	2 17	2 21	2 25
	28	2 17	2 26	2 34	2 44	2 50	2 57	3 04	3 14	3 18	3 23	3 28	3 34	3 41
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	31	4 40	4 53	5 08	5 25	5 35	5 46	5 59	6 15	6 22	6 31	6 40	6 51	7 03
	32	5 28	5 42	5 57	6 15	6 25	6 36	6 50	7 07	7 14	7 23	7 33	7 44	7 57

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
 MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	7 30	7 18	7 06	6 51	6 42	6 33	6 21	6 07	6 01	5 54	5 46	5 36	5 26
	1	8 28	8 18	8 08	7 56	7 49	7 41	7 32	7 21	7 16	7 10	7 04	6 57	6 49
	2	9 22	9 15	9 07	8 59	8 54	8 49	8 43	8 35	8 31	8 27	8 23	8 18	8 13
	3	10 12	10 08	10 04	10 00	9 57	9 54	9 51	9 47	9 45	9 42	9 40	9 38	9 35
	4	11 00	10 59	10 58	10 58	10 57	10 57	10 56	10 55	10 55	10 55	10 54	10 54	10 54
	5	11 45	11 48	11 50	11 53	11 55	11 57	11 59	12 02	12 03	12 04	12 06	12 08	12 10
	6	12 30	12 36	12 41	12 47	12 51	12 55	13 00	13 06	13 09	13 12	13 15	13 19	13 23
	7	13 15	13 23	13 31	13 40	13 46	13 52	14 00	14 09	14 13	14 17	14 22	14 28	14 34
	8	14 00	14 10	14 20	14 33	14 40	14 48	14 58	15 09	15 15	15 21	15 27	15 35	15 43
	9	14 45	14 57	15 10	15 24	15 33	15 42	15 54	16 08	16 14	16 21	16 29	16 38	16 49
	10	15 31	15 45	15 59	16 15	16 24	16 35	16 48	17 03	17 11	17 19	17 28	17 38	17 50
	11	16 19	16 33	16 47	17 04	17 14	17 26	17 39	17 55	18 03	18 11	18 21	18 32	18 44
	12	17 06	17 20	17 35	17 52	18 02	18 13	18 26	18 42	18 50	18 58	19 08	19 19	19 31
	13	17 54	18 08	18 22	18 38	18 47	18 57	19 10	19 25	19 32	19 40	19 48	19 58	20 10
	14	18 42	18 54	19 07	19 21	19 29	19 38	19 49	20 02	20 09	20 15	20 23	20 31	20 41
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	16	20 17	20 24	20 32	20 41	20 46	20 51	20 58	21 06	21 10	21 14	21 18	21 23	21 29
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	18	21 50	21 52	21 53	21 55	21 56	21 58	21 59	22 01	22 01	22 02	22 03	22 04	22 05
	19	22 38	22 36	22 35	22 33	22 32	22 31	22 29	22 28	22 27	22 26	22 25	22 24	22 23
	20	23 27	23 22	23 17	23 12	23 08	23 05	23 01	22 56	22 53	22 51	22 48	22 45	22 42
	21	23 53	23 48	23 42	23 35	23 27	23 23	23 19	23 14	23 09	23 03
	22	0 18	0 10	0 02	23 57	23 51	23 45	23 38	23 29
	23	1 12	1 02	0 51	0 38	0 31	0 23	0 13	0 02
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	28	6 09	5 58	5 46	5 33	5 25	5 16	5 06	4 53	4 47	4 40	4 33	4 25	4 15
	29	7 06	6 57	6 48	6 38	6 32	6 25	6 17	6 08	6 03	5 58	5 53	5 47	5 40
Feb.	30	7 59	7 53	7 48	7 41	7 37	7 33	7 28	7 22	7 19	7 16	7 13	7 09	7 05
	31	8 49	8 47	8 45	8 42	8 40	8 38	8 36	8 34	8 33	8 32	8 30	8 29	8 27
	1	9 37	9 38	9 39	9 40	9 41	9 42	9 43	9 44	9 44	9 45	9 45	9 46	9 46
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	3	11 09	11 16	11 23	11 31	11 36	11 41	11 48	11 55	11 59	12 03	12 07	12 11	12 17
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	14	19 48	19 50	19 53	19 56	19 58	20 00	20 03	20 05	20 07	20 08	20 10	20 11	20 13
	15	20 36	20 35	20 35	20 34	20 34	20 34	20 33	20 33	20 33	20 32	20 32	20 32	20 31
	16	21 25	21 21	21 17	21 13	21 11	21 08	21 04	21 01	20 59	20 57	20 55	20 53	20 50

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
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Jan.	0	19 58	20 09	20 21	20 34	20 41	20 50	21 00	21 12	21 18	21 24	21 31	21 38	21 47
	1	20 54	21 02	21 11	21 21	21 26	21 33	21 40	21 49	21 53	21 58	22 03	22 08	22 15
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	5	23 59	23 55	23 52	23 49	23 46	23 41	23 40	23 37	23 35	23 33	23 30
	6	0 07	0 03	23 57	23 53	23 48
	7	0 52	0 45	0 38	0 30	0 26	0 21	0 15	0 08	0 05	0 01
	8	1 36	1 27	1 18	1 07	1 01	0 54	0 45	0 36	0 31	0 26	0 20	0 14	0 07
	9	2 21	2 10	1 59	1 45	1 38	1 29	1 19	1 06	1 00	0 54	0 47	0 39	0 30
	10	3 07	2 55	2 41	2 26	2 17	2 07	1 55	1 41	1 34	1 26	1 18	1 09	0 58
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	13	5 30	5 16	5 02	4 45	4 35	4 24	4 11	3 55	3 48	3 39	3 30	3 19	3 07
	14	6 18	6 05	5 52	5 36	5 28	5 17	5 05	4 51	4 44	4 36	4 28	4 18	4 07
	15	7 05	6 54	6 43	6 30	6 22	6 13	6 03	5 50	5 44	5 38	5 31	5 23	5 13
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	21	11 51	11 57	12 04	12 11	12 16	12 21	12 27	12 33	12 37	12 40	12 44	12 49	12 53
	22	12 43	12 52	13 02	13 13	13 20	13 27	13 36	13 46	13 51	13 56	14 02	14 08	14 16
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	27	17 39	17 51	18 03	18 18	18 27	18 36	18 48	19 01	19 07	19 14	19 22	19 31	19 41
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Feb.	30	20 23	20 27	20 31	20 36	20 38	20 41	20 45	20 49	20 51	20 53	20 55	20 57	21 00
	31	21 13	21 13	21 14	21 15	21 15	21 16	21 16	21 17	21 17	21 18	21 18	21 18	21 19
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	4	23 56	23 44	23 37	23 28	23 19	23 08	23 03	22 57	22 51	22 43	22 35
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	15	8 11	8 10	8 09	8 07	8 07	8 06	8 05	8 03	8 03	8 02	8 01	8 01	8 00
	16	8 59	9 01	9 03	9 06	9 07	9 09	9 11	9 13	9 14	9 15	9 17	9 18	9 20

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	20 36	20 35	20 35	20 34	20 34	20 34	20 33	20 33	20 33	20 32	20 32	20 32	20 31
	16	21 25	21 21	21 17	21 13	21 11	21 08	21 04	21 01	20 59	20 57	20 55	20 53	20 50
	17	22 15	22 09	22 02	21 54	21 49	21 44	21 38	21 31	21 27	21 24	21 20	21 16	21 11
	18	23 08	22 58	22 48	22 37	22 30	22 23	22 14	22 04	21 59	21 54	21 48	21 42	21 35
	19	.. ..	23 51	23 38	23 24	23 16	23 07	22 56	22 43	22 37	22 30	22 23	22 15	22 05
	20	0 02	.. ..	.. ..	.. ..	.. ..	23 56	23 43	23 28	23 21	23 14	23 05	22 55	22 44
	21	0 59	0 46	0 32	0 16	0 06	.. ..	.. ..	.. ..	.. ..	.. ..	23 57	23 46	23 34
	22	1 57	1 44	1 29	1 12	1 02	0 51	0 38	0 22	0 14	0 06	.. ..	.. ..	.. ..
	23	2 56	2 43	2 29	2 12	2 03	1 52	1 39	1 23	1 16	1 08	0 59	0 49	0 37
	24	3 54	3 42	3 30	3 15	3 06	2 57	2 45	2 31	2 25	2 18	2 10	2 01	1 50
	25	4 51	4 41	4 30	4 19	4 12	4 04	3 55	3 43	3 38	3 33	3 26	3 19	3 11
	26	5 45	5 38	5 30	5 22	5 17	5 11	5 05	4 57	4 53	4 49	4 45	4 40	4 34
	27	6 36	6 33	6 28	6 24	6 21	6 18	6 14	6 10	6 08	6 06	6 03	6 01	5 58
	28	7 26	7 25	7 25	7 24	7 23	7 23	7 22	7 21	7 21	7 21	7 20	7 20	7 19
	29	8 14	8 16	8 19	8 22	8 24	8 25	8 28	8 30	8 32	8 33	8 35	8 36	8 38
Mar.	1	9 01	9 06	9 12	9 18	9 22	9 26	9 31	9 37	9 40	9 43	9 47	9 51	9 55
	2	9 47	9 55	10 04	10 13	10 19	10 25	10 33	10 42	10 46	10 51	10 56	11 02	11 08
	3	10 33	10 43	10 54	11 07	11 14	11 22	11 32	11 44	11 49	11 55	12 02	12 10	12 18
	4	11 20	11 32	11 44	11 59	12 08	12 17	12 29	12 43	12 49	12 57	13 05	13 14	13 24
	5	12 06	12 20	12 34	12 50	12 59	13 10	13 23	13 38	13 45	13 53	14 02	14 12	14 24
	6	12 54	13 07	13 22	13 39	13 49	14 00	14 13	14 29	14 37	14 45	14 54	15 05	15 17
	7	13 41	13 55	14 09	14 26	14 35	14 47	15 00	15 15	15 23	15 31	15 40	15 51	16 03
	8	14 29	14 42	14 55	15 11	15 20	15 30	15 42	15 57	16 04	16 11	16 20	16 29	16 40
	9	15 17	15 28	15 40	15 54	16 02	16 11	16 21	16 34	16 40	16 46	16 54	17 02	17 11
	10	16 05	16 14	16 24	16 35	16 41	16 49	16 57	17 07	17 12	17 17	17 23	17 29	17 37
	11	16 53	16 59	17 07	17 15	17 19	17 24	17 31	17 38	17 41	17 45	17 49	17 54	17 59
	12	17 41	17 45	17 49	17 53	17 56	17 59	18 03	18 07	18 09	18 11	18 13	18 16	18 18
	13	18 30	18 30	18 31	18 32	18 33	18 33	18 34	18 35	18 35	18 35	18 36	18 36	18 37
	14	19 20	19 17	19 14	19 11	19 10	19 08	19 06	19 03	19 02	19 01	18 59	18 58	18 56
	15	20 11	20 05	19 59	19 52	19 48	19 44	19 39	19 33	19 30	19 27	19 24	19 20	19 16
	16	21 04	20 55	20 46	20 36	20 30	20 23	20 15	20 06	20 02	19 57	19 52	19 46	19 40
	17	21 58	21 47	21 36	21 22	21 15	21 06	20 56	20 44	20 38	20 32	20 25	20 17	20 08
	18	22 55	22 42	22 28	22 13	22 04	21 54	21 42	21 27	21 20	21 13	21 04	20 55	20 44
	19	23 52	23 39	23 24	23 07	22 58	22 47	22 33	22 18	22 10	22 02	21 53	21 42	21 30
	20	.. ..	.. ..	.. ..	.. ..	23 56	23 45	23 32	23 16	23 08	23 00	22 51	22 40	22 28
	21	0 50	0 36	0 22	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 48	23 37
	22	1 47	1 35	1 21	1 06	0 57	0 47	0 35	0 20	0 14	0 06
	23	2 42	2 32	2 20	2 08	2 00	1 51	1 41	1 29	1 23	1 17	1 10	1 02	0 53
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	25	4 27	4 22	4 16	4 10	4 06	4 02	3 57	3 52	3 49	3 46	3 43	3 39	3 35
	26	5 17	5 15	5 12	5 10	5 08	5 07	5 05	5 02	5 01	5 00	4 59	4 58	4 56
	27	6 05	6 06	6 07	6 08	6 09	6 10	6 11	6 12	6 12	6 13	6 14	6 15	6 15
	28	6 52	6 56	7 00	7 05	7 08	7 11	7 15	7 20	7 22	7 24	7 27	7 30	7 33
	29	7 39	7 46	7 53	8 01	8 06	8 12	8 18	8 26	8 29	8 33	8 38	8 43	8 48
	30	8 25	8 35	8 44	8 56	9 02	9 10	9 19	9 30	9 35	9 40	9 46	9 53	10 01
Apr.	31	9 12	9 23	9 35	9 49	9 57	10 07	10 17	10 30	10 37	10 43	10 51	10 59	11 09
	1	9 59	10 12	10 25	10 41	10 50	11 01	11 13	11 28	11 35	11 43	11 51	12 01	12 12
	2	10 46	11 00	11 14	11 31	11 41	11 52	12 05	12 21	12 28	12 37	12 46	12 56	13 09

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)

MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	8 11	8 10	8 09	8 07	8 07	8 06	8 05	8 03	8 03	8 02	8 01	8 01	8 00
	16	8 59	9 01	9 03	9 06	9 07	9 09	9 11	9 13	9 14	9 15	9 17	9 18	9 20
	17	9 49	9 54	9 59	10 06	10 09	10 14	10 18	10 24	10 27	10 30	10 33	10 37	10 41
	18	10 40	10 48	10 57	11 07	11 12	11 19	11 27	11 36	11 40	11 45	11 50	11 56	12 02
	19	11 33	11 44	11 56	12 08	12 16	12 25	12 35	12 47	12 53	12 59	13 06	13 14	13 23
	20	12 29	12 42	12 55	13 11	13 20	13 30	13 42	13 56	14 03	14 11	14 19	14 29	14 40
	21	13 27	13 40	13 55	14 12	14 22	14 33	14 46	15 02	15 09	15 17	15 26	15 37	15 49
	22	14 26	14 39	14 54	15 11	15 20	15 31	15 44	16 00	16 08	16 16	16 25	16 36	16 48
	23	15 24	15 37	15 50	16 06	16 15	16 25	16 37	16 52	16 58	17 06	17 14	17 24	17 34
	24	16 21	16 32	16 44	16 57	17 05	17 13	17 23	17 36	17 41	17 47	17 54	18 02	18 11
	25	17 17	17 25	17 34	17 44	17 50	17 56	18 04	18 13	18 17	18 22	18 27	18 33	18 39
	26	18 10	18 15	18 21	18 27	18 31	18 35	18 40	18 46	18 49	18 52	18 55	18 58	19 02
	27	19 00	19 03	19 05	19 08	19 09	19 11	19 13	19 16	19 17	19 18	19 19	19 21	19 22
	28	19 49	19 48	19 47	19 46	19 46	19 45	19 44	19 43	19 43	19 42	19 42	19 41	19 41
	29	20 37	20 33	20 29	20 24	20 21	20 18	20 15	20 10	20 08	20 06	20 04	20 01	19 59
Mar.	1	21 23	21 16	21 09	21 01	20 57	20 52	20 46	20 38	20 35	20 31	20 27	20 23	20 18
	2	22 09	22 00	21 51	21 39	21 33	21 26	21 18	21 07	21 03	20 58	20 52	20 46	20 39
	3	22 56	22 45	22 33	22 19	22 11	22 03	21 52	21 40	21 34	21 27	21 20	21 12	21 03
	4	23 42	23 30	23 16	23 01	22 52	22 42	22 30	22 15	22 08	22 01	21 53	21 43	21 32
	5	...	...	...	23 45	23 35	23 24	23 11	22 56	22 48	22 40	22 31	22 21	22 08
	6	0 29	0 16	0 01	...	...	...	23 57	23 41	23 33	23 25	23 16	23 05	22 53
	7	1 17	1 03	0 48	0 31	0 22	0 10	...	...	...	...	...	23 57	23 45
	8	2 04	1 51	1 37	1 20	1 11	1 00	0 47	0 32	0 25	0 16	0 07	...	...
	9	2 52	2 40	2 27	2 12	2 03	1 54	1 42	1 28	1 21	1 14	1 06	0 56	0 46
	10	3 40	3 29	3 18	3 06	2 58	2 50	2 40	2 28	2 23	2 16	2 10	2 02	1 53
	11	4 28	4 20	4 11	4 01	3 56	3 49	3 41	3 32	3 28	3 23	3 18	3 12	3 06
	12	5 16	5 10	5 05	4 58	4 54	4 50	4 45	4 39	4 36	4 33	4 30	4 26	4 22
	13	6 04	6 02	5 59	5 57	5 55	5 53	5 51	5 48	5 47	5 46	5 44	5 43	5 41
	14	6 53	6 54	6 55	6 56	6 57	6 57	6 58	6 59	7 00	7 00	7 00	7 01	7 02
	15	7 44	7 48	7 52	7 57	8 00	8 03	8 07	8 12	8 14	8 16	8 18	8 21	8 24
	16	8 36	8 43	8 50	8 59	9 04	9 10	9 17	9 25	9 28	9 33	9 37	9 42	9 48
	17	9 29	9 39	9 50	10 02	10 09	10 17	10 26	10 37	10 43	10 49	10 55	11 02	11 10
	18	10 25	10 37	10 50	11 05	11 13	11 23	11 34	11 48	11 55	12 02	12 10	12 19	12 29
	19	11 22	11 35	11 50	12 06	12 16	12 27	12 39	12 55	13 02	13 10	13 19	13 30	13 41
	20	12 20	12 34	12 48	13 05	13 15	13 26	13 39	13 55	14 03	14 11	14 20	14 31	14 43
	21	13 17	13 31	13 45	14 01	14 10	14 20	14 33	14 48	14 55	15 03	15 11	15 21	15 32
	22	14 14	14 25	14 38	14 52	15 00	15 09	15 20	15 33	15 39	15 46	15 53	16 01	16 11
	23	15 08	15 18	15 28	15 39	15 45	15 53	16 01	16 12	16 16	16 22	16 27	16 34	16 41
	24	16 01	16 07	16 14	16 22	16 27	16 32	16 38	16 45	16 48	16 52	16 56	17 00	17 05
	25	16 51	16 55	16 59	17 03	17 05	17 08	17 12	17 15	17 17	17 19	17 21	17 23	17 26
	26	17 40	17 40	17 41	17 42	17 42	17 42	17 43	17 43	17 43	17 44	17 44	17 44	17 45
	27	18 27	18 25	18 22	18 19	18 17	18 15	18 13	18 10	18 09	18 08	18 06	18 04	18 02
	28	19 14	19 09	19 03	18 57	18 53	18 49	18 44	18 38	18 35	18 32	18 29	18 25	18 21
	29	20 01	19 53	19 44	19 35	19 29	19 23	19 15	19 06	19 02	18 58	18 53	18 47	18 41
	30	20 48	20 38	20 27	20 14	20 07	19 58	19 49	19 37	19 32	19 26	19 20	19 12	19 04
Apr.	31	21 35	21 23	21 10	20 55	20 47	20 37	20 26	20 12	20 05	19 58	19 50	19 42	19 31
	1	22 22	22 09	21 54	21 38	21 29	21 18	21 06	20 50	20 43	20 35	20 26	20 16	20 05
	2	23 09	22 55	22 41	22 24	22 14	22 03	21 50	21 34	21 26	21 18	21 08	20 58	20 45

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date		Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
			<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>	<div>h m</div>
Apr.	1		9 59	10 12	10 25	10 41	10 50	11 01	11 13	11 28	11 35	11 43	11 51	12 01	12 12
	2		10 46	11 00	11 14	11 31	11 41	11 52	12 05	12 21	12 28	12 37	12 46	12 56	13 09
	3		11 34	11 47	12 02	12 19	12 29	12 40	12 53	13 09	13 17	13 25	13 34	13 45	13 57
	4		12 21	12 34	12 48	13 04	13 14	13 24	13 37	13 52	13 59	14 07	14 16	14 26	14 38
	5		13 08	13 20	13 33	13 48	13 56	14 06	14 17	14 31	14 37	14 44	14 52	15 01	15 11
	6		13 56	14 06	14 17	14 29	14 36	14 44	14 54	15 05	15 10	15 16	15 23	15 30	15 38
	7		14 43	14 51	14 59	15 09	15 14	15 21	15 28	15 37	15 41	15 45	15 50	15 55	16 01
	8		15 31	15 36	15 41	15 48	15 51	15 55	16 00	16 06	16 08	16 11	16 14	16 18	16 22
	9		16 19	16 21	16 24	16 26	16 28	16 29	16 31	16 34	16 35	16 36	16 37	16 39	16 41
	10		17 09	17 08	17 07	17 05	17 05	17 04	17 03	17 02	17 02	17 01	17 01	17 00	16 59
	11		18 00	17 56	17 51	17 46	17 43	17 40	17 36	17 32	17 30	17 27	17 25	17 22	17 19
	12		18 53	18 46	18 38	18 29	18 24	18 18	18 12	18 04	18 00	17 56	17 52	17 47	17 41
	13		19 49	19 39	19 28	19 16	19 09	19 01	18 51	18 40	18 35	18 29	18 23	18 16	18 08
	14		20 47	20 35	20 22	20 07	19 58	19 48	19 37	19 23	19 16	19 09	19 01	18 52	18 42
	15		21 46	21 32	21 18	21 01	20 52	20 41	20 28	20 12	20 05	19 57	19 48	19 38	19 26
	16		22 45	22 31	22 16	21 59	21 50	21 38	21 25	21 09	21 02	20 53	20 44	20 33	20 21
	17		23 43	23 30	23 16	23 00	22 51	22 40	22 28	22 13	22 06	21 58	21 49	21 39	21 27
	18		...	...	...	...	23 53	23 44	23 33	23 20	23 14	23 08	23 00	22 52	22 42
	19		0 39	0 27	0 15	0 01	...	...	...	...	...	...	...	...	...
	20		1 32	1 23	1 14	1 03	0 56	0 49	0 41	0 30	0 26	0 20	0 15	0 08	0 01
	21		2 23	2 17	2 11	2 03	1 59	1 54	1 48	1 41	1 38	1 34	1 30	1 26	1 21
	22		3 12	3 09	3 06	3 02	3 00	2 57	2 54	2 51	2 49	2 47	2 45	2 43	2 41
	23		4 00	4 00	4 00	3 59	3 59	3 59	3 59	3 59	3 59	3 59	3 59	3 59	3 59
	24		4 47	4 49	4 53	4 56	4 58	5 00	5 03	5 07	5 08	5 10	5 12	5 14	5 16
	25		5 33	5 39	5 45	5 52	5 56	6 01	6 06	6 13	6 16	6 19	6 23	6 27	6 31
	26		6 19	6 27	6 36	6 47	6 53	6 59	7 07	7 17	7 21	7 26	7 32	7 38	7 45
	27		7 06	7 16	7 27	7 41	7 48	7 57	8 07	8 19	8 25	8 31	8 38	8 46	8 55
	28		7 53	8 05	8 18	8 33	8 42	8 52	9 04	9 18	9 25	9 32	9 41	9 50	10 01
	29		8 40	8 53	9 08	9 24	9 34	9 45	9 58	10 13	10 21	10 29	10 38	10 49	11 01
	30		9 27	9 41	9 56	10 13	10 23	10 34	10 48	11 04	11 12	11 20	11 29	11 40	11 53
May	1		10 15	10 28	10 43	10 59	11 09	11 20	11 33	11 49	11 56	12 05	12 14	12 24	12 36
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	7		14 56	14 57	15 41	14 58	14 59	14 59	15 00	15 01	15 01	15 01	15 02	15 02	15 03
	8		15 46	15 44	15 41	15 38	15 36	15 34	15 32	15 29	15 28	15 26	15 25	15 23	15 21
	9		16 39	16 33	16 26	16 19	16 15	16 11	16 06	15 59	15 57	15 54	15 50	15 46	15 42
	10		17 34	17 25	17 15	17 05	16 59	16 52	16 43	16 34	16 29	16 25	16 19	16 13	16 06
	11		18 32	18 20	18 08	17 54	17 46	17 37	17 27	17 14	17 08	17 02	16 54	16 46	16 37
	12		19 32	19 19	19 05	18 49	18 39	18 29	18 16	18 01	17 54	17 46	17 38	17 28	17 16
	13		20 34	20 20	20 05	19 48	19 38	19 26	19 13	18 57	18 49	18 41	18 31	18 21	18 08
	14		21 34	21 21	21 06	20 50	20 40	20 29	20 16	20 00	19 53	19 45	19 35	19 25	19 13
	15		22 33	22 21	22 08	21 53	21 44	21 34	21 23	21 09	21 02	20 55	20 47	20 38	20 27
	16		23 29	23 19	23 08	22 56	22 49	22 41	22 31	22 20	22 15	22 09	22 02	21 55	21 47
	17		23 57	23 52	23 46	23 40	23 32	23 28	23 24	23 19	23 14	23 08
	18		0 21	0 14	0 06

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	1	22 22	22 09	21 54	21 38	21 29	21 18	21 06	20 50	20 43	20 35	20 26	20 16	20 05
	2	23 09	22 55	22 41	22 24	22 14	22 03	21 50	21 34	21 26	21 18	21 08	20 58	20 45
	3	23 56	23 43	23 28	23 12	23 02	22 51	22 38	22 22	22 15	22 06	21 57	21 46	21 34
	4	...	...	...	...	23 53	23 42	23 30	23 15	23 08	23 01	22 52	22 42	22 31
	5	0 44	0 31	0 17	0 02	...	...	...	...	...	...	23 53	23 44	23 35
	6	1 31	1 20	1 08	0 54	0 46	0 37	0 26	0 13	0 07	0 00	...	...	...
	7	2 18	2 09	1 59	1 48	1 42	1 34	1 25	1 15	1 10	1 05	0 59	0 52	0 44
	8	3 06	2 59	2 52	2 44	2 39	2 34	2 28	2 20	2 16	2 13	2 08	2 04	1 58
	9	3 54	3 50	3 46	3 41	3 39	3 36	3 32	3 28	3 26	3 24	3 21	3 19	3 16
	10	4 42	4 42	4 41	4 40	4 40	4 40	4 39	4 38	4 38	4 37	4 37	4 37	4 36
	11	5 33	5 36	5 38	5 42	5 43	5 46	5 48	5 51	5 52	5 54	5 55	5 57	5 59
	12	6 25	6 31	6 37	6 45	6 49	6 54	6 59	7 06	7 09	7 12	7 16	7 20	7 24
	13	7 20	7 29	7 38	7 49	7 55	8 02	8 11	8 21	8 26	8 31	8 36	8 43	8 50
	14	8 16	8 28	8 40	8 54	9 02	9 11	9 22	9 35	9 41	9 48	9 55	10 04	10 14
	15	9 15	9 28	9 42	9 58	10 08	10 18	10 31	10 46	10 53	11 01	11 10	11 20	11 31
	16	10 14	10 28	10 43	11 00	11 10	11 21	11 34	11 50	11 58	12 06	12 15	12 26	12 38
	17	11 13	11 26	11 41	11 57	12 07	12 18	12 31	12 46	12 53	13 01	13 10	13 21	13 32
	18	12 10	12 22	12 35	12 50	12 59	13 08	13 20	13 34	13 40	13 47	13 55	14 04	14 14
	19	13 05	13 15	13 26	13 38	13 45	13 53	14 03	14 14	14 19	14 25	14 31	14 38	14 46
	20	13 57	14 05	14 13	14 22	14 27	14 33	14 40	14 48	14 52	14 56	15 01	15 06	15 11
	21	14 47	14 52	14 57	15 02	15 06	15 09	15 13	15 18	15 21	15 23	15 26	15 29	15 32
	22	15 35	15 37	15 39	15 41	15 42	15 43	15 45	15 46	15 47	15 48	15 49	15 50	15 51
	23	16 22	16 21	16 19	16 18	16 17	16 16	16 14	16 13	16 12	16 11	16 10	16 10	16 09
	24	17 09	17 04	17 00	16 54	16 51	16 48	16 44	16 39	16 37	16 35	16 32	16 29	16 26
	25	17 55	17 48	17 40	17 32	17 27	17 21	17 15	17 07	17 03	16 59	16 55	16 50	16 45
	26	18 41	18 32	18 22	18 10	18 04	17 56	17 47	17 37	17 32	17 26	17 20	17 14	17 06
	27	19 28	19 17	19 04	18 51	18 42	18 33	18 22	18 09	18 03	17 57	17 49	17 41	17 31
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	30	21 50	21 36	21 21	21 05	20 55	20 43	20 30	20 14	20 06	19 58	19 48	19 37	19 25
May	1	22 37	22 24	22 10	21 54	21 44	21 33	21 21	21 05	20 58	20 50	20 41	20 30	20 18
	2	23 24	23 12	22 59	22 45	22 36	22 26	22 15	22 01	21 54	21 47	21 39	21 30	21 19
	3	...	...	23 50	23 37	23 30	23 22	23 12	23 00	22 55	22 49	22 42	22 34	22 26
	4	0 11	0 00	...	...	...	...	...	...	23 58	23 54	23 48	23 43	23 36
	5	0 57	0 49	0 41	0 31	0 25	0 19	0 11	0 02	...	...	...	...	...
	6	1 44	1 38	1 33	1 27	1 23	1 19	1 14	1 08	1 05	1 02	0 59	0 55	0 51
	7	2 31	2 29	2 26	2 24	2 22	2 20	2 18	2 16	2 15	2 13	2 12	2 10	2 09
	8	3 20	3 21	3 22	3 23	3 24	3 25	3 25	3 26	3 27	3 27	3 28	3 29	3 29
	9	4 11	4 15	4 20	4 25	4 28	4 31	4 35	4 40	4 42	4 44	4 47	4 50	4 53
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	11	6 01	6 11	6 22	6 35	6 42	6 51	7 00	7 12	7 18	7 24	7 31	7 38	7 47
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	13	8 01	8 15	8 30	8 47	8 57	9 08	9 21	9 37	9 45	9 53	10 02	10 13	10 25
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	17	11 54	12 03	12 12	12 22	12 28	12 35	12 43	12 52	12 56	13 01	13 06	13 12	13 18
	18	12 45	12 51	12 57	13 04	13 08	13 12	13 17	13 24	13 26	13 29	13 33	13 37	13 41

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
 MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May	17	0 21	0 14	0 06	23 57	23 52	23 46	23 40	23 32	23 28	23 24	23 19	23 14	23 08
	18	0 21	0 14	0 06	23 57	23 52	23 46	23 40	23 32	23 28	23 24	23 19	23 14	23 08
	19	1 11	1 07	1 02	0 57	0 54	0 50	0 47	0 42	0 40	0 37	0 35	0 32	0 29
	20	1 58	1 57	1 56	1 55	1 54	1 53	1 52	1 51	1 50	1 49	1 49	1 48	1 47
	21	2 45	2 47	2 49	2 51	2 52	2 54	2 56	2 58	2 59	3 00	3 01	3 03	3 04
	22	3 30	3 35	3 40	3 46	3 50	3 54	3 58	4 03	4 06	4 09	4 12	4 15	4 19
	23	4 16	4 24	4 32	4 41	4 46	4 52	4 59	5 08	5 12	5 16	5 21	5 27	5 33
	24	5 02	5 12	5 22	5 35	5 42	5 50	5 59	6 10	6 16	6 22	6 28	6 35	6 44
	25	5 48	6 00	6 13	6 27	6 36	6 45	6 57	7 10	7 17	7 24	7 32	7 41	7 51
	26	6 35	6 49	7 03	7 19	7 28	7 39	7 52	8 07	8 15	8 23	8 32	8 42	8 54
	27	7 23	7 37	7 52	8 09	8 19	8 30	8 43	9 00	9 07	9 16	9 26	9 36	9 49
	28	8 10	8 24	8 39	8 56	9 06	9 17	9 31	9 47	9 55	10 03	10 13	10 23	10 36
	29	8 57	9 11	9 25	9 41	9 50	10 01	10 14	10 29	10 36	10 44	10 53	11 03	11 14
	30	9 44	9 56	10 09	10 23	10 32	10 41	10 52	11 06	11 12	11 19	11 27	11 36	11 46
	31	10 30	10 40	10 51	11 03	11 10	11 18	11 27	11 39	11 44	11 50	11 56	12 03	12 11
June	1	11 16	11 24	11 32	11 41	11 46	11 53	12 00	12 08	12 12	12 16	12 21	12 27	12 32
	2	12 01	12 06	12 12	12 18	12 21	12 25	12 30	12 36	12 38	12 41	12 44	12 47	12 51
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	4	13 35	13 34	13 33	13 32	13 31	13 31	13 30	13 29	13 28	13 28	13 27	13 27	13 26
	5	14 25	14 21	14 16	14 11	14 08	14 05	14 01	13 57	13 55	13 53	13 50	13 48	13 45
	6	15 17	15 10	15 02	14 54	14 49	14 43	14 36	14 28	14 25	14 21	14 16	14 12	14 06
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	9	18 15	18 01	17 46	17 29	17 19	17 08	16 55	16 39	16 32	16 24	16 14	16 04	15 52
	10	19 18	19 04	18 49	18 31	18 21	18 10	17 57	17 40	17 33	17 24	17 14	17 04	16 51
	11	20 20	20 06	19 53	19 36	19 27	19 17	19 04	18 49	18 42	18 34	18 25	18 15	18 03
	12	21 19	21 08	20 56	20 42	20 34	20 25	20 15	20 02	19 56	19 49	19 42	19 34	19 24
	13	22 15	22 06	21 57	21 47	21 41	21 34	21 26	21 16	21 12	21 07	21 02	20 55	20 49
	14	23 07	23 01	22 55	22 49	22 45	22 41	22 35	22 29	22 27	22 23	22 20	22 16	22 12
	15	23 56	23 54	23 51	23 49	23 47	23 45	23 43	23 40	23 39	23 38	23 37	23 35	23 33
	16	0 43	0 44	0 45	0 46	0 47	0 47	0 48	0 49	0 50	0 50	0 51	0 51	0 52
	17	1 29	1 33	1 37	1 42	1 45	1 48	1 51	1 56	1 58	2 00	2 02	2 05	2 08
	18	2 15	2 21	2 29	2 37	2 41	2 47	2 53	3 00	3 04	3 08	3 12	3 17	3 22
	19	3 00	3 09	3 19	3 30	3 37	3 44	3 53	4 03	4 08	4 13	4 19	4 26	4 34
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	23	6 07	6 21	6 36	6 54	7 04	7 15	7 29	7 45	7 53	8 01	8 11	8 22	8 35
	24	6 55	7 08	7 23	7 39	7 49	8 00	8 13	8 29	8 36	8 45	8 54	9 04	9 16
	25	7 42	7 54	8 08	8 23	8 32	8 42	8 54	9 08	9 15	9 22	9 30	9 40	9 50
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	29	10 44	10 47	10 51	10 55	10 57	11 00	11 03	11 07	11 08	11 10	11 12	11 15	11 17
	30	11 30	11 30	11 30	11 31	11 31	11 32	11 32	11 32	11 33	11 33	11 33	11 34	11 34
July	1	12 17	12 14	12 11	12 08	12 06	12 04	12 02	11 59	11 58	11 56	11 55	11 53	11 51
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
May	17	h m 11 54	h m 12 03	h m 12 12	h m 12 22	h m 12 28	h m 12 35	h m 12 43	h m 12 52	h m 12 56	h m 13 01	h m 13 06	h m 13 12	h m 13 18
	18	12 45	12 51	12 57	13 04	13 08	13 12	13 17	13 24	13 26	13 29	13 33	13 37	13 41
	19	13 34	13 37	13 39	13 43	13 44	13 47	13 49	13 52	13 53	13 54	13 56	13 58	13 59
	20	14 21	14 20	14 20	14 20	14 19	14 19	14 19	14 18	14 18	14 18	14 17	14 17	14 17
	21	15 07	15 03	15 00	14 56	14 53	14 51	14 48	14 44	14 42	14 41	14 39	14 36	14 34
	22	15 52	15 46	15 40	15 32	15 28	15 23	15 17	15 11	15 08	15 04	15 00	14 56	14 52
	23	16 38	16 29	16 20	16 10	16 03	15 57	15 48	15 39	15 35	15 30	15 24	15 18	15 11
	24	17 24	17 13	17 02	16 49	16 41	16 32	16 22	16 10	16 04	15 58	15 51	15 43	15 34
	25	18 11	17 59	17 45	17 30	17 21	17 11	16 59	16 45	16 38	16 31	16 22	16 13	16 02
	26	18 58	18 45	18 30	18 14	18 04	17 53	17 40	17 24	17 17	17 08	16 59	16 49	16 37
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	28	20 33	20 19	20 05	19 48	19 38	19 27	19 14	18 58	18 50	18 42	18 32	18 22	18 09
	29	21 20	21 07	20 54	20 38	20 29	20 19	20 07	19 52	19 45	19 37	19 28	19 19	19 07
	30	22 06	21 55	21 43	21 30	21 22	21 13	21 02	20 49	20 43	20 37	20 29	20 21	20 11
	31	22 52	22 43	22 34	22 22	22 16	22 09	22 00	21 50	21 45	21 40	21 34	21 27	21 20
June	1	23 38	23 31	23 24	23 16	23 12	23 06	23 00	22 53	22 50	22 46	22 42	22 37	22 32
	2	23 58	23 56	23 54	23 52	23 49	23 46
	3	0 23	0 20	0 16	0 11	0 09	0 06	0 02
	4	1 10	1 10	1 09	1 08	1 08	1 07	1 07	1 06	1 06	1 05	1 05	1 04	1 04
	5	1 59	2 01	2 04	2 07	2 09	2 11	2 13	2 16	2 17	2 19	2 20	2 22	2 24
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	15	11 31	11 35	11 39	11 43	11 46	11 49	11 53	11 57	11 59	12 01	12 03	12 05	12 08
	16	12 19	12 20	12 21	12 21	12 22	12 23	12 23	12 24	12 24	12 25	12 25	12 25	12 26
	17	13 06	13 03	13 01	12 58	12 57	12 55	12 53	12 50	12 49	12 48	12 46	12 45	12 43
	18	13 51	13 46	13 41	13 34	13 31	13 27	13 22	13 16	13 14	13 11	13 08	13 04	13 00
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	22	16 56	16 42	16 28	16 12	16 02	15 51	15 39	15 23	15 16	15 08	14 59	14 49	14 37
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	25	19 17	19 04	18 50	18 34	18 25	18 14	18 01	17 46	17 38	17 30	17 21	17 11	16 59
	26	20 04	19 52	19 40	19 25	19 17	19 07	18 56	18 42	18 36	18 28	18 21	18 12	18 01
	27	20 50	20 40	20 30	20 17	20 10	20 02	19 53	19 42	19 36	19 30	19 24	19 17	19 08
	28	21 35	21 28	21 20	21 11	21 05	20 59	20 52	20 44	20 39	20 35	20 30	20 25	20 19
	29	22 20	22 15	22 10	22 04	22 01	21 57	21 52	21 47	21 44	21 42	21 39	21 35	21 31
	30	23 06	23 04	23 02	22 59	22 58	22 57	22 55	22 52	22 51	22 50	22 49	22 48	22 46
July	1	23 52	23 53	23 54	23 56	23 57	23 58	23 59
	2	0 00	0 00	0 01	0 02	0 02	0 03

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
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	2	12 17	12 14	12 11	12 08	12 06	12 04	12 02	11 59	11 58	11 56	11 55	11 53	11 51
	3	13 06	13 01	12 54	12 47	12 43	12 39	12 34	12 28	12 25	12 22	12 18	12 14	12 10
	4	13 59	13 50	13 41	13 30	13 24	13 17	13 09	13 00	12 56	12 51	12 45	12 40	12 33
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	9	19 01	18 49	18 36	18 21	18 12	18 02	17 50	17 36	17 30	17 22	17 14	17 05	16 54
	10	20 01	19 51	19 40	19 28	19 21	19 13	19 03	18 52	18 47	18 41	18 34	18 27	18 19
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	12	21 49	21 45	21 41	21 36	21 34	21 31	21 27	21 23	21 21	21 19	21 17	21 14	21 11
	13	22 38	22 38	22 37	22 37	22 36	22 36	22 35	22 35	22 35	22 34	22 34	22 34	22 33
	14	23 26	23 29	23 31	23 35	23 36	23 38	23 41	23 44	23 45	23 47	23 48	23 50	23 52
	15
	16	0 12	0 18	0 24	0 31	0 35	0 39	0 44	0 50	0 53	0 57	1 00	1 04	1 08
	17	0 58	1 06	1 15	1 25	1 31	1 38	1 45	1 55	1 59	2 04	2 09	2 15	2 22
	18	1 44	1 55	2 06	2 19	2 26	2 35	2 45	2 56	3 02	3 08	3 15	3 23	3 32
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Aug.	31	11 52	11 44	11 36	11 27	11 22	11 16	11 09	11 01	10 57	10 53	10 49	10 44	10 38
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	16	1 13	1 26	1 40	1 56	2 05	2 16	2 28	2 44	2 51	2 59	3 07	3 18	3 29
	17	2 01	2 14	2 29	2 46	2 56	3 07	3 20	3 36	3 44	3 53	4 02	4 13	4 25

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	23 52	23 53	23 54	23 56	23 57	23 58	23 59	h m	h m	h m	h m	h m	h m
	2	...	...	...	...	...	...	...	0 00	0 00	0 01	0 02	0 02	0 03
	3	0 40	0 44	0 49	0 54	0 57	1 01	1 05	1 09	1 12	1 14	1 17	1 20	1 23
	4	1 31	1 38	1 46	1 55	2 00	2 06	2 13	2 21	2 25	2 29	2 34	2 39	2 45
	5	2 25	2 35	2 46	2 58	3 06	3 14	3 23	3 35	3 40	3 46	3 53	4 00	4 09
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	10	7 30	7 41	7 53	8 06	8 14	8 23	8 33	8 46	8 51	8 58	9 05	9 13	9 22
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	12	9 22	9 27	9 33	9 39	9 43	9 47	9 52	9 58	10 00	10 03	10 06	10 10	10 14
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	14	11 01	11 00	10 59	10 58	10 57	10 56	10 55	10 54	10 54	10 53	10 52	10 52	10 51
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	16	12 34	12 28	12 20	12 12	12 07	12 02	11 56	11 48	11 45	11 41	11 37	11 32	11 27
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	20	15 40	15 26	15 12	14 55	14 45	14 34	14 21	14 05	13 57	13 49	13 39	13 29	13 16
	21	16 27	16 13	15 59	15 41	15 31	15 20	15 07	14 50	14 42	14 34	14 24	14 13	14 01
	22	17 15	17 01	16 47	16 30	16 21	16 10	15 57	15 41	15 33	15 25	15 16	15 05	14 53
	23	18 02	17 49	17 36	17 21	17 12	17 02	16 50	16 36	16 29	16 22	16 13	16 04	15 53
	24	18 48	18 38	18 26	18 13	18 06	17 57	17 47	17 35	17 29	17 23	17 16	17 08	16 59
	25	19 34	19 26	19 17	19 06	19 00	18 54	18 46	18 36	18 32	18 27	18 21	18 15	18 08
	26	20 19	20 14	20 07	20 00	19 56	19 51	19 46	19 39	19 36	19 33	19 29	19 25	19 20
	27	21 04	21 01	20 58	20 55	20 53	20 50	20 47	20 44	20 42	20 41	20 39	20 37	20 34
	28	21 50	21 50	21 50	21 50	21 50	21 50	21 50	21 50	21 50	21 50	21 50	21 50	21 50
	29	22 37	22 40	22 43	22 47	22 49	22 52	22 54	22 58	22 59	23 01	23 03	23 05	23 07
	30	23 25	23 31	23 38	23 45	23 50	23 55	...	...	...	...	...	...	...
Aug.	31	...	...	...	...	...	...	0 00	0 07	0 10	0 14	0 17	0 22	0 27
	1	0 16	0 25	0 35	0 46	0 52	0 59	1 08	1 18	1 22	1 28	1 33	1 40	1 47
	2	1 10	1 22	1 34	1 48	1 56	2 05	2 16	2 29	2 35	2 42	2 49	2 58	3 08
	3	2 08	2 21	2 35	2 51	3 00	3 11	3 24	3 39	3 46	3 54	4 03	4 13	4 25
	4	3 08	3 22	3 37	3 54	4 04	4 15	4 29	4 45	4 52	5 01	5 10	5 21	5 34
	5	4 09	4 23	4 38	4 54	5 04	5 15	5 28	5 44	5 51	5 59	6 08	6 19	6 31
	6	5 10	5 23	5 36	5 51	5 59	6 09	6 21	6 34	6 41	6 48	6 56	7 05	7 15
	7	6 10	6 20	6 31	6 43	6 49	6 57	7 06	7 17	7 22	7 28	7 34	7 41	7 49
	8	7 07	7 14	7 21	7 30	7 35	7 40	7 46	7 54	7 57	8 01	8 05	8 10	8 15
	9	8 00	8 04	8 08	8 13	8 15	8 18	8 22	8 26	8 28	8 30	8 32	8 34	8 37
	10	8 52	8 52	8 53	8 53	8 54	8 54	8 54	8 55	8 55	8 55	8 56	8 56	8 56
	11	9 41	9 38	9 35	9 32	9 30	9 28	9 26	9 23	9 21	9 20	9 18	9 16	9 14
	12	10 29	10 23	10 17	10 10	10 06	10 02	9 56	9 50	9 48	9 44	9 41	9 37	9 33
	13	11 15	11 07	10 58	10 48	10 43	10 36	10 28	10 19	10 15	10 10	10 05	9 59	9 53
	14	12 02	11 52	11 40	11 28	11 20	11 12	11 02	10 50	10 45	10 39	10 32	10 24	10 16
	15	12 49	12 37	12 24	12 09	12 00	11 50	11 39	11 25	11 18	11 11	11 03	10 54	10 43
	16	13 36	13 23	13 08	12 52	12 42	12 32	12 19	12 03	11 56	11 48	11 39	11 28	11 17
	17	14 23	14 10	13 55	13 38	13 28	13 16	13 03	12 47	12 39	12 31	12 21	12 10	11 58

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)

MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug.	16	13 36	13 23	13 08	12 52	12 42	12 32	12 19	12 03	11 56	11 48	11 39	11 28	11 17
	17	14 23	14 10	13 55	13 38	13 28	13 16	13 03	12 47	12 39	12 31	12 21	12 10	11 58
	18	15 11	14 57	14 42	14 26	14 16	14 05	13 52	13 35	13 28	13 19	13 10	12 59	12 47
	19	15 58	15 45	15 31	15 16	15 07	14 56	14 44	14 29	14 22	14 14	14 06	13 56	13 44
	20	16 45	16 34	16 22	16 08	16 00	15 51	15 40	15 27	15 21	15 14	15 06	14 58	14 48
	21	17 31	17 22	17 12	17 01	16 54	16 47	16 38	16 28	16 23	16 17	16 11	16 05	15 57
	22	18 17	18 10	18 03	17 55	17 50	17 45	17 38	17 31	17 27	17 23	17 19	17 14	17 09
	23	19 03	18 59	18 55	18 50	18 47	18 44	18 40	18 36	18 34	18 31	18 29	18 26	18 23
	24	19 49	19 48	19 47	19 46	19 45	19 44	19 43	19 42	19 41	19 41	19 40	19 40	19 39
	25	20 35	20 37	20 40	20 42	20 44	20 45	20 47	20 50	20 51	20 52	20 53	20 54	20 56
	26	21 23	21 28	21 34	21 40	21 44	21 48	21 53	21 58	22 01	22 04	22 07	22 11	22 15
	27	22 13	22 21	22 29	22 39	22 45	22 51	22 59	23 08	23 12	23 17	23 22	23 28	23 34
	28	23 05	23 16	23 27	23 40	23 47	23 56	...	...	...	...	...	...	...
	29	...	...	...	...	...	...	0 06	0 18	0 24	0 30	0 37	0 45	0 54
	30	0 00	0 12	0 26	0 41	0 50	1 00	1 12	1 27	1 33	1 41	1 49	1 59	2 10
Sept.	31	0 57	1 11	1 25	1 42	1 52	2 03	2 16	2 32	2 40	2 48	2 57	3 08	3 20
	1	1 56	2 10	2 25	2 42	2 51	3 03	3 16	3 32	3 39	3 48	3 57	4 08	4 20
	2	2 55	3 08	3 22	3 38	3 47	3 57	4 10	4 24	4 31	4 39	4 47	4 57	5 08
	3	3 54	4 05	4 17	4 30	4 38	4 47	4 57	5 10	5 15	5 22	5 29	5 37	5 45
	4	4 51	5 00	5 09	5 19	5 25	5 31	5 39	5 48	5 53	5 57	6 02	6 08	6 15
	5	5 46	5 51	5 57	6 04	6 07	6 12	6 16	6 22	6 25	6 28	6 31	6 34	6 38
	6	6 38	6 41	6 43	6 45	6 47	6 49	6 50	6 53	6 54	6 55	6 56	6 57	6 59
	7	7 29	7 28	7 27	7 25	7 25	7 24	7 23	7 21	7 21	7 20	7 19	7 19	7 18
	8	8 18	8 14	8 09	8 04	8 01	7 58	7 54	7 50	7 47	7 45	7 43	7 40	7 36
	9	9 07	9 00	8 52	8 43	8 38	8 33	8 26	8 18	8 15	8 11	8 07	8 02	7 56
	10	9 55	9 45	9 35	9 23	9 16	9 09	9 00	8 49	8 44	8 39	8 33	8 26	8 18
	11	10 42	10 31	10 18	10 04	9 56	9 47	9 36	9 23	9 16	9 10	9 02	8 54	8 44
	12	11 30	11 17	11 03	10 47	10 38	10 27	10 15	10 00	9 53	9 45	9 37	9 27	9 15
	13	12 17	12 04	11 49	11 32	11 22	11 11	10 58	10 42	10 34	10 26	10 17	10 06	9 53
	14	13 05	12 51	12 36	12 19	12 09	11 58	11 45	11 29	11 21	11 13	11 03	10 52	10 40
	15	13 52	13 39	13 25	13 09	12 59	12 48	12 36	12 20	12 13	12 05	11 56	11 46	11 34
	16	14 39	14 27	14 14	14 00	13 51	13 42	13 30	13 16	13 10	13 03	12 55	12 46	12 35
	17	15 26	15 16	15 05	14 52	14 45	14 37	14 28	14 16	14 11	14 05	13 58	13 51	13 42
	18	16 12	16 04	15 56	15 46	15 41	15 35	15 27	15 19	15 14	15 10	15 05	14 59	14 53
	19	16 58	16 53	16 48	16 41	16 38	16 34	16 29	16 23	16 21	16 18	16 15	16 11	16 07
	20	17 44	17 42	17 40	17 38	17 36	17 34	17 32	17 30	17 29	17 28	17 26	17 25	17 23
	21	18 31	18 32	18 33	18 35	18 35	18 36	18 37	18 38	18 39	18 39	18 40	18 41	18 41
	22	19 20	19 24	19 28	19 33	19 36	19 40	19 43	19 48	19 50	19 52	19 55	19 58	20 01
	23	20 10	20 17	20 24	20 33	20 38	20 44	20 51	20 59	21 03	21 07	21 11	21 16	21 22
	24	21 02	21 11	21 22	21 34	21 41	21 49	21 58	22 10	22 15	22 21	22 27	22 34	22 42
	25	21 56	22 08	22 21	22 35	22 44	22 54	23 05	23 19	23 26	23 33	23 41	23 50	...
	26	22 52	23 05	23 20	23 36	23 46	23 57	...	...	...	...	...	...	0 00
	27	23 50	...	...	...	...	...	0 10	0 25	0 33	0 41	0 50	1 00	1 12
	28	...	0 04	0 18	0 35	0 45	0 57	1 10	1 26	1 34	1 42	1 52	2 02	2 15
	29	0 47	1 01	1 15	1 32	1 41	1 52	2 04	2 20	2 27	2 35	2 44	2 54	3 06
Oct.	30	1 45	1 57	2 09	2 24	2 32	2 42	2 53	3 06	3 12	3 19	3 27	3 35	3 45
	1	2 41	2 50	3 01	3 12	3 19	3 26	3 35	3 46	3 51	3 56	4 02	4 09	4 16
	2	3 35	3 41	3 49	3 57	4 02	4 07	4 13	4 20	4 24	4 27	4 31	4 36	4 41

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	15 09	15 01	14 52	14 42	14 36	14 29	14 21	14 12	14 08	14 03	13 57	13 51	13 45
	2	16 02	15 57	15 51	15 45	15 41	15 37	15 32	15 26	15 23	15 20	15 17	15 13	15 09
	3	16 54	16 52	16 49	16 47	16 46	16 44	16 42	16 40	16 39	16 38	16 36	16 35	16 34
	4	17 44	17 45	17 46	17 48	17 49	17 50	17 51	17 52	17 53	17 54	17 55	17 56	17 57
	5	18 33	18 37	18 42	18 47	18 51	18 54	18 58	19 03	19 06	19 08	19 11	19 14	19 18
	6	19 21	19 29	19 37	19 46	19 51	19 57	20 04	20 12	20 16	20 20	20 25	20 30	20 36
	7	20 10	20 20	20 30	20 42	20 49	20 57	21 07	21 18	21 23	21 29	21 36	21 43	21 51
	8	20 58	21 10	21 23	21 37	21 46	21 55	22 07	22 20	22 27	22 34	22 42	22 51	23 01
	9	21 47	22 00	22 14	22 30	22 39	22 50	23 03	23 18	23 26	23 34	23 43	23 53	...
	10	22 35	22 48	23 03	23 20	23 30	23 42	23 55	...	...	...	...	...	0 05
	11	23 22	23 36	23 51	...	...	...	...	0 11	0 19	0 27	0 37	0 48	1 00
	12	...	...	...	0 08	0 18	0 29	0 42	0 58	1 06	1 15	1 24	1 35	1 47
	13	0 09	0 23	0 37	0 53	1 02	1 13	1 25	1 40	1 47	1 55	2 04	2 14	2 25
	14	0 56	1 08	1 20	1 35	1 43	1 52	2 03	2 17	2 23	2 30	2 38	2 46	2 56
	15	1 42	1 52	2 03	2 15	2 21	2 29	2 38	2 49	2 55	3 00	3 06	3 13	3 21
	16	2 28	2 36	2 44	2 53	2 58	3 04	3 11	3 19	3 23	3 27	3 32	3 37	3 43
	17	3 14	3 19	3 24	3 30	3 33	3 37	3 41	3 46	3 49	3 52	3 54	3 58	4 01
	18	4 00	4 02	4 04	4 07	4 08	4 09	4 11	4 13	4 14	4 15	4 16	4 17	4 19
	19	4 48	4 47	4 46	4 44	4 43	4 42	4 41	4 40	4 39	4 39	4 38	4 37	4 36
	20	5 37	5 33	5 28	5 23	5 20	5 16	5 12	5 08	5 06	5 03	5 01	4 58	4 55
	21	6 29	6 21	6 13	6 04	5 59	5 53	5 47	5 38	5 35	5 31	5 26	5 21	5 16
	22	7 23	7 12	7 01	6 49	6 42	6 34	6 25	6 13	6 08	6 02	5 56	5 49	5 41
	23	8 19	8 06	7 53	7 38	7 29	7 19	7 08	6 54	6 47	6 40	6 32	6 23	6 13
	24	9 17	9 03	8 48	8 31	8 22	8 11	7 58	7 42	7 34	7 26	7 17	7 07	6 55
	25	10 15	10 01	9 46	9 29	9 19	9 07	8 54	8 38	8 30	8 21	8 12	8 01	7 48
	26	11 13	11 00	10 46	10 29	10 20	10 09	9 56	9 41	9 33	9 25	9 16	9 06	8 54
	27	12 10	11 58	11 46	11 31	11 23	11 14	11 03	10 49	10 43	10 36	10 28	10 19	10 09
	28	13 04	12 55	12 45	12 34	12 27	12 20	12 11	12 00	11 55	11 50	11 44	11 37	11 29
	29	13 57	13 51	13 44	13 36	13 31	13 26	13 20	13 13	13 09	13 06	13 02	12 57	12 52
	30	14 48	14 44	14 41	14 37	14 34	14 32	14 29	14 25	14 23	14 22	14 20	14 17	14 15
Nov.	31	15 37	15 37	15 37	15 36	15 37	15 36	15 36	15 36	15 36	15 36	15 36	15 36	15 36
	1	16 25	16 28	16 32	16 35	16 38	16 40	16 43	16 47	16 48	16 50	16 52	16 54	16 57
	2	17 13	17 19	17 26	17 33	17 38	17 43	17 49	17 55	17 59	18 02	18 06	18 11	18 16
	3	18 01	18 10	18 20	18 30	18 37	18 44	18 52	19 03	19 07	19 13	19 18	19 25	19 32
	4	18 50	19 01	19 13	19 26	19 34	19 43	19 54	20 07	20 13	20 20	20 27	20 35	20 45
	5	19 38	19 51	20 05	20 20	20 30	20 40	20 52	21 07	21 15	21 22	21 31	21 41	21 52
	6	20 27	20 41	20 55	21 12	21 22	21 33	21 47	22 03	22 11	22 19	22 29	22 40	22 52
	7	21 15	21 29	21 44	22 01	22 11	22 23	22 37	22 53	23 01	23 10	23 19	23 30	23 43
	8	22 03	22 16	22 31	22 48	22 57	23 08	23 21	23 37	23 45	23 53	...	...	...
	9	22 49	23 02	23 15	23 31	23 39	23 50	...	...	...	...	0 02	0 13	0 25
	10	23 35	23 46	23 58	...	...	...	0 02	0 16	0 23	0 30	0 38	0 48	0 58
	11	...	...	...	0 11	0 19	0 27	0 38	0 50	0 55	1 02	1 09	1 16	1 25
	12	0 21	0 29	0 39	0 49	0 55	1 02	1 10	1 20	1 24	1 29	1 35	1 41	1 48
	13	1 06	1 12	1 19	1 26	1 30	1 35	1 41	1 48	1 51	1 54	1 58	2 02	2 07
	14	1 51	1 55	1 58	2 02	2 05	2 07	2 10	2 14	2 16	2 17	2 19	2 22	2 24
	15	2 37	2 38	2 38	2 38	2 39	2 39	2 39	2 40	2 40	2 40	2 40	2 41	2 41
	16	3 25	3 23	3 20	3 16	3 14	3 12	3 09	3 06	3 05	3 04	3 02	3 00	2 58
	17	4 16	4 10	4 03	3 56	3 52	3 47	3 42	3 35	3 32	3 29	3 26	3 22	3 17

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
Date		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
Oct.	1	2 41	2 50	3 01	3 12	3 19	3 26	3 35	3 46	3 51	3 56	4 02	4 09	4 16
	2	3 35	3 41	3 49	3 57	4 02	4 07	4 13	4 20	4 24	4 27	4 31	4 36	4 41
	3	4 27	4 31	4 35	4 39	4 41	4 44	4 48	4 51	4 53	4 55	4 57	4 59	5 02
	4	5 18	5 18	5 19	5 19	5 19	5 19	5 20	5 20	5 20	5 20	5 21	5 21	5 21
	5	6 07	6 04	6 01	5 58	5 56	5 54	5 51	5 48	5 47	5 45	5 43	5 42	5 39
	6	6 56	6 50	6 44	6 37	6 33	6 28	6 23	6 16	6 14	6 10	6 07	6 03	5 58
	7	7 45	7 36	7 27	7 17	7 11	7 04	6 56	6 46	6 42	6 37	6 32	6 26	6 19
	8	8 33	8 22	8 11	7 58	7 50	7 41	7 31	7 19	7 13	7 07	7 00	6 52	6 44
	9	9 21	9 09	8 55	8 40	8 31	8 21	8 09	7 55	7 48	7 41	7 33	7 23	7 12
	10	10 10	9 56	9 42	9 25	9 15	9 04	8 51	8 35	8 28	8 20	8 11	8 00	7 48
	11	10 58	10 44	10 29	10 12	10 02	9 50	9 37	9 21	9 13	9 04	8 55	8 44	8 31
	12	11 45	11 31	11 17	11 00	10 50	10 39	10 26	10 10	10 03	9 54	9 45	9 34	9 22
	13	12 32	12 19	12 06	11 50	11 42	11 31	11 19	11 04	10 58	10 50	10 41	10 32	10 21
	14	13 18	13 07	12 56	12 42	12 34	12 26	12 15	12 02	11 57	11 50	11 43	11 34	11 25
	15	14 04	13 55	13 46	13 35	13 29	13 22	13 14	13 04	12 59	12 54	12 48	12 42	12 34
	16	14 50	14 44	14 37	14 29	14 25	14 20	14 14	14 07	14 04	14 00	13 56	13 52	13 47
	17	15 36	15 33	15 29	15 25	15 23	15 20	15 17	15 13	15 11	15 09	15 07	15 05	15 02
	18	16 23	16 23	16 22	16 22	16 22	16 22	16 21	16 21	16 21	16 20	16 20	16 20	16 20
	19	17 11	17 14	17 17	17 21	17 23	17 25	17 28	17 31	17 32	17 34	17 36	17 38	17 40
	20	18 02	18 08	18 14	18 21	18 26	18 31	18 36	18 43	18 46	18 49	18 53	18 57	19 02
	21	18 54	19 03	19 13	19 24	19 30	19 37	19 46	19 56	20 00	20 06	20 11	20 18	20 25
	22	19 49	20 00	20 13	20 27	20 35	20 44	20 55	21 08	21 14	21 21	21 29	21 37	21 47
	23	20 46	20 59	21 13	21 30	21 39	21 50	22 02	22 18	22 25	22 33	22 42	22 52	23 04
	24	21 44	21 58	22 13	22 31	22 41	22 52	23 05	23 22	23 29	23 38	23 48	23 58	...
	25	22 43	22 57	23 12	23 28	23 38	23 49	...	...	...	...	...	...	0 11
	26	23 40	23 53	...	...	...	...	0 02	0 18	0 26	0 34	0 43	0 54	1 06
	27	...	...	0 06	0 22	0 31	0 41	0 52	1 07	1 13	1 21	1 29	1 38	1 48
	28	0 36	0 47	0 58	1 11	1 18	1 26	1 36	1 48	1 53	1 59	2 06	2 13	2 21
	29	1 30	1 38	1 46	1 55	2 01	2 07	2 14	2 23	2 27	2 31	2 36	2 41	2 47
	30	2 21	2 26	2 31	2 37	2 40	2 44	2 49	2 54	2 56	2 59	3 02	3 05	3 08
Nov.	31	3 11	3 13	3 15	3 17	3 18	3 19	3 21	3 22	3 23	3 24	3 25	3 26	3 27
	1	4 00	3 58	3 57	3 55	3 54	3 53	3 51	3 49	3 49	3 48	3 47	3 46	3 45
	2	4 48	4 44	4 39	4 33	4 30	4 26	4 22	4 17	4 15	4 12	4 09	4 06	4 03
	3	5 36	5 29	5 21	5 12	5 06	5 00	4 54	4 45	4 42	4 37	4 33	4 28	4 22
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	5	7 13	7 01	6 48	6 34	6 25	6 15	6 04	5 50	5 44	5 37	5 29	5 21	5 11
	6	8 02	7 48	7 34	7 18	7 08	6 57	6 45	6 29	6 22	6 14	6 05	5 55	5 43
	7	8 50	8 36	8 21	8 04	7 54	7 42	7 29	7 12	7 05	6 56	6 46	6 35	6 23
	8	9 38	9 24	9 09	8 52	8 42	8 30	8 17	8 00	7 53	7 44	7 34	7 23	7 11
	9	10 25	10 12	9 58	9 42	9 32	9 21	9 09	8 53	8 46	8 38	8 29	8 18	8 06
	10	11 12	11 00	10 47	10 33	10 24	10 14	10 03	9 49	9 43	9 36	9 28	9 19	9 08
	11	11 57	11 47	11 37	11 25	11 18	11 09	11 00	10 49	10 43	10 37	10 31	10 24	10 15
	12	12 42	12 35	12 27	12 17	12 12	12 06	11 59	11 50	11 46	11 42	11 37	11 32	11 25
	13	13 27	13 23	13 17	13 11	13 08	13 04	13 00	12 54	12 52	12 49	12 46	12 42	12 38
	14	14 13	14 11	14 09	14 07	14 06	14 04	14 02	14 00	13 59	13 58	13 57	13 55	13 54
	15	15 00	15 01	15 03	15 04	15 05	15 06	15 07	15 09	15 09	15 10	15 11	15 11	15 12
	16	15 49	15 53	15 58	16 04	16 07	16 10	16 15	16 19	16 22	16 24	16 27	16 30	16 34
	17	16 41	16 48	16 56	17 06	17 11	17 17	17 24	17 33	17 37	17 41	17 46	17 51	17 57

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov.	16	3 25	3 23	3 20	3 16	3 14	3 12	3 09	3 06	3 05	3 04	3 02	3 00	2 58
	17	4 16	4 10	4 03	3 56	3 52	3 47	3 42	3 35	3 32	3 29	3 26	3 22	3 17
	18	5 09	5 00	4 50	4 40	4 33	4 26	4 18	4 08	4 04	3 59	3 53	3 47	3 40
	19	6 05	5 54	5 41	5 27	5 19	5 10	4 59	4 47	4 41	4 34	4 27	4 18	4 09
	20	7 04	6 51	6 37	6 20	6 11	6 00	5 47	5 32	5 25	5 17	5 08	4 58	4 47
	21	8 05	7 51	7 35	7 18	7 08	6 56	6 43	6 26	6 19	6 10	6 00	5 49	5 37
	22	9 05	8 51	8 37	8 19	8 10	7 58	7 45	7 29	7 21	7 13	7 03	6 52	6 40
	23	10 04	9 52	9 39	9 23	9 14	9 04	8 52	8 38	8 31	8 23	8 15	8 05	7 54
	24	11 01	10 51	10 40	10 27	10 20	10 11	10 02	9 50	9 44	9 38	9 32	9 24	9 15
	25	11 55	11 47	11 39	11 30	11 25	11 18	11 11	11 03	10 59	10 55	10 50	10 45	10 39
Dec.	26	12 46	12 41	12 36	12 31	12 28	12 24	12 20	12 15	12 13	12 11	12 08	12 05	12 02
	27	13 35	13 33	13 32	13 31	13 30	13 29	13 28	13 27	13 26	13 25	13 25	13 24	13 23
	28	14 22	14 24	14 26	14 29	14 30	14 32	14 34	14 36	14 37	14 38	14 40	14 41	14 43
	29	15 09	15 14	15 20	15 26	15 30	15 34	15 38	15 44	15 47	15 50	15 53	15 57	16 01
	30	15 56	16 04	16 13	16 22	16 28	16 34	16 42	16 51	16 55	17 00	17 05	17 11	17 17
	1	16 44	16 54	17 05	17 18	17 25	17 34	17 44	17 56	18 01	18 07	18 14	18 22	18 31
	2	17 32	17 44	17 57	18 12	18 21	18 31	18 43	18 57	19 04	19 12	19 20	19 29	19 40
	3	18 20	18 34	18 48	19 05	19 15	19 26	19 39	19 55	20 03	20 11	20 20	20 31	20 43
	4	19 09	19 23	19 38	19 56	20 06	20 17	20 31	20 48	20 56	21 05	21 14	21 25	21 39
	5	19 57	20 11	20 26	20 43	20 53	21 05	21 18	21 35	21 42	21 51	22 01	22 12	22 24
	6	20 44	20 57	21 12	21 28	21 37	21 48	22 00	22 16	22 23	22 31	22 39	22 49	23 01
	7	21 30	21 42	21 55	22 09	22 17	22 27	22 38	22 51	22 58	23 04	23 12	23 21	23 30
	8	22 16	22 25	22 36	22 48	22 55	23 03	23 12	23 22	23 28	23 33	23 39	23 46	23 54
	9	23 00	23 08	23 16	23 25	23 30	23 36	23 42	23 51	23 54	23 59	...	...	...
	10	23 45	23 49	23 54	...	...	...	...	...	...	...	0 03	0 08	0 14
	11	...	...	...	0 00	0 03	0 07	0 11	0 17	0 19	0 22	0 25	0 28	0 31
	12	0 29	0 31	0 33	0 35	0 36	0 38	0 40	0 42	0 43	0 44	0 45	0 46	0 47
	13	1 15	1 14	1 12	1 11	1 10	1 09	1 08	1 07	1 06	1 06	1 05	1 05	1 04
	14	2 03	1 58	1 54	1 48	1 45	1 42	1 38	1 34	1 32	1 29	1 27	1 24	1 21
	15	2 53	2 46	2 38	2 29	2 24	2 18	2 11	2 03	2 00	1 56	1 51	1 46	1 41
	16	3 47	3 37	3 26	3 14	3 07	2 58	2 49	2 38	2 33	2 27	2 21	2 14	2 06
	17	4 45	4 32	4 19	4 04	3 55	3 45	3 33	3 19	3 13	3 05	2 57	2 48	2 38
	18	5 46	5 32	5 17	5 00	4 50	4 38	4 25	4 09	4 02	3 53	3 44	3 33	3 21
	19	6 48	6 34	6 18	6 01	5 51	5 39	5 25	5 09	5 01	4 52	4 42	4 31	4 18
	20	7 50	7 37	7 23	7 06	6 57	6 46	6 33	6 17	6 10	6 02	5 52	5 42	5 30
	21	8 51	8 39	8 27	8 13	8 04	7 55	7 44	7 31	7 25	7 18	7 10	7 02	6 52
	22	9 48	9 39	9 29	9 19	9 12	9 05	8 57	8 47	8 42	8 37	8 32	8 25	8 18
	23	10 41	10 36	10 30	10 23	10 19	10 14	10 09	10 02	10 00	9 56	9 53	9 49	9 44
	24	11 32	11 30	11 27	11 24	11 23	11 21	11 18	11 16	11 15	11 13	11 12	11 10	11 08
	25	12 21	12 22	12 23	12 24	12 24	12 25	12 26	12 27	12 27	12 28	12 28	12 29	12 30
	26	13 08	13 12	13 16	13 21	13 24	13 27	13 31	13 36	13 38	13 40	13 43	13 45	13 49
	27	13 55	14 02	14 09	14 18	14 23	14 28	14 35	14 43	14 46	14 50	14 55	15 00	15 05
	28	14 42	14 51	15 01	15 13	15 20	15 27	15 36	15 47	15 52	15 58	16 04	16 11	16 19
	29	15 29	15 40	15 53	16 07	16 15	16 25	16 36	16 50	16 56	17 03	17 11	17 20	17 30
	30	16 17	16 30	16 44	17 00	17 09	17 20	17 33	17 48	17 56	18 04	18 13	18 23	18 35
	31	17 05	17 19	17 34	17 51	18 01	18 13	18 26	18 43	18 51	18 59	19 09	19 20	19 33
	32	17 53	18 07	18 22	18 40	18 50	19 01	19 15	19 32	19 40	19 49	19 58	20 10	20 22

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	15 49	15 53	15 58	16 04	16 07	16 10	16 15	16 19	16 22	16 24	16 27	16 30	16 34
17	16 41	16 48	16 56	17 06	17 11	17 17	17 24	17 33	17 37	17 41	17 46	17 51	17 57
18	17 35	17 46	17 57	18 10	18 17	18 25	18 35	18 47	18 53	18 59	19 06	19 13	19 22
19	18 33	18 46	18 59	19 15	19 24	19 34	19 46	20 01	20 07	20 15	20 24	20 33	20 44
20	19 33	19 47	20 02	20 19	20 29	20 40	20 54	21 10	21 18	21 26	21 36	21 46	21 59
21	20 34	20 48	21 03	21 20	21 31	21 42	21 55	22 12	22 20	22 28	22 38	22 49	23 02
22	21 34	21 47	22 01	22 17	22 27	22 37	22 50	23 05	23 12	23 20	23 29	23 39	23 50
23	22 32	22 43	22 55	23 09	23 17	23 26	23 37	23 50	23 55	...	...	...	...
24	23 27	23 36	23 45	23 56	...	...	...	...	...	0 02	0 09	0 17	0 27
25	...	...	...	...	0 02	0 09	0 17	0 27	0 31	0 36	0 42	0 48	0 54
26	0 19	0 25	0 31	0 39	0 43	0 47	0 53	0 59	1 02	1 05	1 09	1 13	1 17
27	1 09	1 12	1 15	1 18	1 20	1 22	1 25	1 28	1 29	1 31	1 32	1 34	1 36
28	1 57	1 57	1 57	1 56	1 56	1 56	1 55	1 55	1 54	1 54	1 54	1 54	1 53
29	2 45	2 41	2 38	2 33	2 31	2 28	2 25	2 21	2 19	2 17	2 15	2 13	2 10
30	3 32	3 25	3 19	3 11	3 06	3 01	2 55	2 48	2 45	2 41	2 37	2 33	2 28
Dec. 1	4 19	4 10	4 00	3 49	3 43	3 36	3 27	3 17	3 13	3 08	3 02	2 56	2 48
2	5 07	4 56	4 44	4 30	4 22	4 13	4 02	3 49	3 43	3 37	3 30	3 22	3 12
3	5 55	5 42	5 28	5 13	5 03	4 53	4 41	4 26	4 19	4 11	4 02	3 53	3 42
4	6 44	6 30	6 15	5 58	5 48	5 36	5 23	5 07	4 59	4 50	4 41	4 30	4 18
5	7 32	7 18	7 03	6 45	6 35	6 23	6 10	5 53	5 45	5 36	5 26	5 15	5 02
6	8 20	8 06	7 51	7 34	7 25	7 13	7 00	6 44	6 36	6 28	6 18	6 07	5 55
7	9 07	8 54	8 40	8 25	8 16	8 06	7 53	7 39	7 32	7 24	7 15	7 06	6 54
8	9 52	9 41	9 30	9 16	9 09	9 00	8 49	8 37	8 31	8 24	8 17	8 09	8 00
9	10 37	10 28	10 19	10 08	10 02	9 55	9 47	9 37	9 32	9 27	9 22	9 15	9 08
10	11 22	11 15	11 09	11 01	10 57	10 52	10 46	10 39	10 36	10 32	10 28	10 24	10 19
11	12 06	12 02	11 59	11 55	11 52	11 50	11 47	11 43	11 41	11 39	11 37	11 34	11 32
12	12 51	12 50	12 50	12 50	12 49	12 49	12 49	12 48	12 48	12 48	12 47	12 47	12 47
13	13 37	13 40	13 43	13 46	13 48	13 51	13 53	13 56	13 57	13 59	14 01	14 03	14 05
14	14 26	14 32	14 38	14 46	14 50	14 55	15 00	15 07	15 10	15 13	15 17	15 21	15 26
15	15 18	15 27	15 37	15 48	15 54	16 01	16 09	16 20	16 24	16 29	16 35	16 42	16 49
16	16 14	16 26	16 38	16 52	17 00	17 09	17 20	17 34	17 40	17 47	17 54	18 03	18 13
17	17 13	17 27	17 41	17 58	18 07	18 18	18 31	18 47	18 54	19 02	19 11	19 22	19 34
18	18 15	18 29	18 45	19 02	19 12	19 24	19 38	19 54	20 02	20 11	20 21	20 32	20 45
19	19 18	19 32	19 47	20 04	20 14	20 25	20 38	20 54	21 02	21 10	21 20	21 30	21 43
20	20 19	20 32	20 45	21 00	21 09	21 19	21 31	21 45	21 51	21 59	22 07	22 16	22 26
21	21 18	21 28	21 39	21 51	21 58	22 06	22 16	22 27	22 32	22 38	22 44	22 51	22 59
22	22 13	22 21	22 28	22 37	22 42	22 48	22 54	23 02	23 06	23 10	23 14	23 19	23 24
23	23 06	23 10	23 14	23 19	23 22	23 25	23 28	23 33	23 35	23 37	23 39	23 42	23 45
24	23 56	23 56	23 57	23 58	23 59	23 59	...	...	...	...	...	...	...
25	...	...	...	...	...	...	0 00	0 01	0 01	0 01	0 02	0 02	0 03
26	0 44	0 41	0 39	0 36	0 34	0 32	0 30	0 27	0 26	0 25	0 23	0 21	0 20
27	1 31	1 25	1 19	1 13	1 09	1 05	1 00	0 54	0 51	0 48	0 45	0 41	0 37
28	2 17	2 09	2 00	1 51	1 45	1 38	1 31	1 22	1 18	1 13	1 08	1 02	0 56
29	3 04	2 54	2 43	2 30	2 22	2 14	2 04	1 52	1 47	1 41	1 34	1 27	1 18
30	3 52	3 39	3 26	3 11	3 02	2 52	2 41	2 26	2 20	2 12	2 04	1 55	1 45
31	4 40	4 26	4 11	3 55	3 45	3 34	3 21	3 05	2 57	2 49	2 40	2 29	2 17
32	5 28	5 14	4 58	4 41	4 31	4 19	4 05	3 49	3 41	3 32	3 22	3 11	2 58

Place	Description	Altitude	Longitude		
		m	h	m	s
Aarhus, Denmark	Ole Römer Observatory	50	-0	40	47.3 b
Abastuman, Georgian S. S. R.	Astrophysical Obs. of Acad. of Sciences	1700	-2	51	18.08 b
Abbadia, France	Obs. of Paris Acad. of Sci., Hendaye	69	+0	07	00.1 c
Abinger, Surrey	Branch of Royal Greenwich Obs.	235	+0	01	32.77 c
Albany, New York	Dudley Observatory	70	+4	55	07.12 c
Algiers, Algeria	Algiers Observatory, at Bouzaréah	345	-0	12	08.53 c
Alma-Ata, Kazak S. S. R.	Mountain Obs. of Academy of Sciences	1450	-5	07	49.84
Amherst, Mass.	Amherst College Obs., since 1903	110	+4	50	05.93 a
Amsterdam, Netherlands	Tilanus Observatory	30	-0	19	38.81
Ann Arbor, Michigan	Observatory of University of Michigan	282	+5	34	55.27 c
Appleton, Wisconsin	Underwood Obs., Lawrence College	242	+5	53	35.92 a
Arcetri (Florence), Italy	Astrophysical Observatory	184	-0	45	01.30 a
Armagh, Northern Ireland	Armagh Observatory	64	+0	26	35.48 b
Ashkhabad, Turkmen S. S. R.	Astrophysical Lab. of Acad. of Sciences	234	-3	53	24.6 b
Asiago (Vicenza), Italy	Astrophysical Obs. of Padua Univ.	1045	-0	46	06.86 b
Athens, Greece	National Observatory	110	-1	34	52.06 c
Baguio City, Philippines	Manila Observatory	1507	-8	02	19.1
Bamberg, Germany	Remeis Observatory	288	-0	43	33.57 c
Barcelona, Spain	Fabra Observatory	415	-0	08	30.2
Basel-Binningen, Switzerland	Astron.-Meteorol. Inst., Univ. Basel	318	-0	30	20.02
Baton Rouge, Louisiana	Observatory of University of Louisiana	31	+6	04	42.96
Beirut, Lebanon	American University Observatory	38	-2	21	52.7 a
Belgrade, Yugoslavia	Observatory of Academy of Sciences	253	-1	22	03.20
Beloit, Wisconsin	Smith Observatory, Beloit College	—	+5	56	07.4
Berkeley, California	Leuschner Observatory, Univ. of Calif.	94	+8	09	02.91
Berlin, Germany	Wilhelm Foerster Institute	40	-0	53	42 .
Berlin-Babelsberg, Germany	Observatory of Academy of Sciences	82	-0	52	25.49 a
Berlin-Treptow, Germany	Archenhold Observatory	38	-0	53	54.2
Berne, Switzerland	Astronomical Institute of the Univ.	563	-0	29	42.88
Besançon, France	National Observatory	312	-0	23	57.42 c
Beverwijk, Netherlands	Observatory of B. J. Vastenholt	3	-0	18	35.30 b
Billingshurst, Sussex	Observatory of W. B. Caunter	61	+0	02	19.0 a
Blaca, Yugoslavia	Observatory of N. Miličević	223	-1	06	08.0
Blaricum, Netherlands	Observatory of L. J. de Lange	4	-0	20	59.5 b
Bloemfontein, South Africa	Boyden Station, at Mazelspoort	1387	-1	45	37.4 b
Bloomington, Indiana	Kirkwood Obs., University of Indiana	238	+5	46	05 c
Bogotá, Colombia	National Observatory	2640	+4	56	19.51
Bologna, Italy	University Observatory	84	-0	45	24.48
Bombay (Colaba), India	Government Observatory	14	-4	51	15.72 c
Bonn, Germany	University Observatory	62	-0	28	23.18
Bordeaux, France	Obs. of Univ. of Bordeaux, at Floirac	73	+0	02	06.60 c
Bosque Alegre, Argentina	Branch of National Observatory	1250	+4	18	11.2 b
Boston, Massachusetts	Boston University Obs., since 1947	32	+4	44	25.5 a
Brno, Czechoslovakia	Astro. Inst. of the Polytechnic School	277	-1	06	22.3
Brno, Czechoslovakia	Masaryk University Observatory	277	-1	06	23.9

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx	ΔZ
h m	s	° '	° ' "					
0 40.8	- 6.70	- 10 11.8	+56 07 40	+0.82663	0.55864	+1.47970	-238	-353
2 51.3	-28.14	- 42 49.5	+41 45 18.2	+0.66264	0.74731	+0.88669	-319	-283
23 53.0	+ 1.15	+ 1 45.0	+43 22 52.2	+0.68332	0.72796	+0.93868	-311	-292
23 58.5	+ 0.25	+ 0 23.2	+51 11.1	+0.77555	0.62811	+1.23473	-268	-331
19 04.9	+48.48	+ 73 46.8	+42 39 12.8	+0.67406	0.73661	+0.91508	-314	-288
0 12.1	- 1.99	- 3 02.1	+36 48 04.8	+0.59577	0.80173	+0.74310	-342	-254
5 07.8	-50.57	- 76 57.5	+43 11 16.6	+0.68102	0.73043	+0.93236	-312	-291
19 09.9	+47.66	+ 72 31.5	+42 21 56.5	+0.67037	0.74000	+0.90590	-316	-286
0 19.6	- 3.23	- 4 54.7	+52 22 18.3	+0.78833	0.61183	+1.28849	-261	-336
18 25.1	+55.02	+ 83 43.8	+42 16 48.7	+0.66928	0.74102	+0.90319	-316	-286
18 06.4	+58.09	+ 88 24.0	+44 15 39.2	+0.69440	0.71737	+0.96798	-306	-296
0 45.0	- 7.40	- 11 15.3	+43 45 14.4	+0.68804	0.72350	+0.95099	-309	-294
23 33.4	+ 4.37	+ 6 38.9	+54 21 11.1	+0.80897	0.58409	+1.38500	-249	-345
3 53.4	-38.34	- 58 21.2	+37 57 24	+0.61173	0.78951	+0.77482	-337	-261
0 46.1	- 7.58	- 11 31.7	+45 51 44.7	+0.71420	0.69771	+1.02364	-298	-305
1 34.9	-15.58	- 23 43.0	+37 58 19.7	+0.61193	0.78933	+0.77526	-337	-261
8 02.3	-79.23	-120 34.8	+16 24 39	+0.28077	0.95974	+0.29254	-409	-120
0 43.6	- 7.16	- 10 53.4	+49 53 06.4	+0.76114	0.64562	+1.17893	-275	-325
0 08.5	- 1.40	- 2 07.6	+41 24 59.3	+0.65809	0.75108	+0.87620	-320	-281
0 30.3	- 4.98	- 7 35.0	+47 32 27.2	+0.73418	0.67634	+1.08552	-289	-313
17 55.3	+59.91	+ 91 10.7	+30 24 44.1	+0.50325	0.86315	+0.58304	-368	-215
2 21.9	-23.31	- 35 28.2	+33 54 22	+0.55467	0.83083	+0.66761	-354	-237
1 22.1	-13.48	- 20 30.8	+44 48 13.2	+0.70114	0.71074	+0.98649	-303	-299
18 03.9	+58.50	+ 89 01.9	+42 30 08.4	+0.67211	0.73838	+0.91025	-315	-287
15 51.0	+80.34	+122 15.7	+37 52 23.5	+0.61057	0.79039	+0.77250	-337	-260
0 53.7	- 8.82	- 13 25.5	+52 28 30	+0.78943	0.61040	+1.29330	-260	-337
0 52.4	- 8.61	- 13 06.4	+52 24 24.2	+0.78871	0.61135	+1.29011	-261	-336
0 53.9	- 8.86	- 13 28.6	+52 29 07	+0.78954	0.61026	+1.29378	-260	-337
0 29.7	- 4.88	- 7 25.7	+46 57 12.7	+0.72726	0.68388	+1.06343	-292	-310
0 24.0	- 3.94	- 5 59.4	+47 14 59.8	+0.73075	0.68007	+1.07452	-290	-312
0 18.6	- 3.05	- 4 38.8	+52 29 09.0	+0.78954	0.61025	+1.29380	-260	-337
23 57.7	+ 0.38	+ 0 34.7	+51 04 51.7	+0.77439	0.62951	+1.23015	-269	-330
1 06.1	-10.86	- 16 32.0	+43 17 32.3	+0.68221	0.72904	+0.93577	-311	-291
0 21.0	- 3.45	- 5 14.9	+52 16 14.8	+0.78725	0.61322	+1.28380	-262	-336
1 45.6	-17.35	- 26 24.3	-29 02 18	-0.48262	0.87518	-0.55145	-373	+206
18 13.9	+56.85	+ 86 31.3	+39 09 56	+0.62818	0.77640	+0.80910	-331	-268
19 03.7	+48.68	+ 74 04.9	+ 4 35 55.2	+0.07967	0.99722	+0.07989	-425	- 34
0 45.4	- 7.46	- 11 21.1	+44 29 52.4	+0.69733	0.71447	+0.97602	-305	-298
4 51.3	-47.85	- 72 48.9	+18 53 36.2	+0.32174	0.94646	+0.33995	-404	-137
0 28.4	- 4.66	- 7 05.8	+50 43 45.0	+0.77052	0.63427	+1.21481	-271	-329
23 57.9	+ 0.35	+ 0 31.6	+44 50 07	+0.70151	0.71033	+0.98758	-303	-299
19 41.8	+42.41	+ 64 32.8	-31 35 53	-0.52102	0.85270	-0.61102	-364	+222
19 15.6	+46.72	+ 71 06.4	+42 21 00.6	+0.67016	0.74018	+0.90540	-316	-286
1 06.4	-10.90	- 16 35.6	+49 12 24	+0.75347	0.65462	+1.15099	-279	-321
1 06.4	-10.91	- 16 36.0	+49 12 15.1	+0.75344	0.65465	+1.15089	-279	-321

If the horizontal parallax, $\pi = 8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{1}{r} \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta x$, $\cos \theta$, $\Delta Y = \Delta x$, $\sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

Place	Description	Altitude	Longitude			
			m	h	m	s
Brooklyn, Indiana	Goethe Link Obs., University of Ind.	300	+	5	45	34.86 b
Brunswick, Maine	Bowdoin College Observatory	25	+	4	39	51.3 b
Bucharest, Romania	National Observatory	83	-	1	44	23.18
Budapest, Hungary	Konkoly Observatory	474	-	1	15	51.41 c
Buenos Aires, Argentina	Naval Observatory	6	+	3	53	25.22 c
Bussum, Netherlands	Observatory of D. Schmidt	10	-	0	20	41.6
Cambridge, England	University Observatories	28	-	0	00	22.75 c
Cambridge, England	Observatory of W. H. Steavenson	27	-	0	00	22.77 b
Cambridge, Massachusetts	Harvard College Observatory	24	+	4	44	31.05
Canberra, Australia	Commonwealth Obs., on Mount Stromlo	768	-	9	56	01.35 c
Cape of Good Hope, S. Africa	Royal Observatory	10	-	1	13	54.38 c
Cape of Good Hope, S. Africa	Obs. of Astro. Society of South Africa	102	-	1	13	36.8 a
Caracas, Venezuela	Cajigal Observatory	1042	+	4	27	42.61
Carloforte, Sardinia	International Latitude Observatory	18	-	0	33	14.9 d
Carnoustie, Scotland	Observatory of W. B. Ogilvie	8	+	0	10	48.26 a
Castel Gandolfo, Italy	Vatican Observatory	450	-	0	50	36.33
Catania, Sicily	Astrophysical Observatory	47	-	1	00	20.60
Charlottesville, Virginia	Leander McCormick Obs., Univ. of Va.	259	+	5	14	05.33 a
Cincinnati, Ohio	Cincinnati Observatory	247	+	5	37	41.40 a
Claremont, California	F. P. Brackett Obs., Pomona College	368	+	7	50	50.68 c
Cleethorpes, Lincolnshire	Observatory of W. T. Gayfer	—	+	0	00	11.0 b
Cleveland, Ohio	Warner and Swasey Observatory	247	+	5	26	16.36 c
Coimbra, Portugal	University Observatory	99	+	0	33	43.10 c
Columbia, South Carolina	Melton Memorial Obs., Univ. of S. C.	98	+	5	24	06.20 a
Columbus, Ohio	McMillin Observatory, State University	233	+	5	32	02.60 c
Copenhagen, Denmark	University Observatory	14	-	0	50	18.69 a
Copenhagen, Denmark	Urania Observatory	10	-	0	50	09.11 a
Copenhagen, Denmark	Observatory of P. Darnell	—	-	0	49	48.67
Copenhagen, Denmark	Observatory of V. Hegvad	—	-	0	50	01.4
Copenhagen, Denmark	Observatory of S. Kierulff	—	-	0	50	06.4
Copenhagen, Denmark	Observatory of N. P. Wieth-Knudsen	21	-	0	50	13.0
Cordoba, Argentina	National Observatory	434	+	4	16	47.16
Cracow, Poland	University Observatory	221	-	1	19	50.3 a
Danzig, Danzig	Municipal Observatory	31	-	1	14	36.5
Decatur, Georgia	Bradley, Obs., Agnes Scott College	315	+	5	37	10.60 b
Dehra Dun, India	Haig Obs., Trig. Survey of India	682	-	5	12	11.79
Delaware, Ohio	Perkins Obs., Ohio Wesleyan University	270	+	5	32	13.33
Denver, Colorado	Chamberlin Obs., Univ. of Denver	1644	+	6	59	47.72 a
Des Moines, Iowa	Drake University Municipal Obs.	291	+	6	14	44.7 c
Driehuis-Velsen, Netherlands	Observatory of A. Mak	—	-	0	18	34.15 a
Dublin, Ireland	Dunsink Observatory	86	+	0	25	21.1 c
Dunedin, New Zealand	Beverley-Begg Observatory	141	-	11	21	58.05 b
Dunedin, New Zealand	Observatory of G. Couling	200	-	11	21	59.3 a
Edinburgh, Scotland	Royal Observatory	146	+	0	12	44.10 c
Evanston, Illinois	Dearborn Obs., Northwestern Univ.	175	+	5	50	41.84 c

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{xy}	ΔZ
h m	s	° '	° ' "					
18 14.4	+ 56.77	+ 86 23.7	+39 32 57.7	+0.63336	0.77217	+0.82023	-329	-270
19 20.1	+ 45.97	+ 69 57.8	+43 54 33.2	+0.68997	0.72161	+0.95616	-308	-294
1 44.4	- 17.15	- 26 05.8	+44 24 50	+0.69629	0.71549	+0.97316	-305	-297
1 15.9	- 12.46	- 18 57.9	+47 29 58.6	+0.73371	0.67688	+1.08396	-289	-313
20 06.6	+ 38.34	+ 58 21.3	-34 37 18.3	-0.56495	0.82382	-0.68577	-351	+241
0 20.7	- 3.40	- 5 10.4	+52 16 34.2	+0.78731	0.61315	+1.28405	-262	-336
0 00.4	- 0.06	- 0 05.7	+52 12 51.6	+0.78665	0.61400	+1.28119	-262	-336
0 00.4	- 0.06	- 0 05.7	+52 12 53.3	+0.78666	0.61400	+1.28121	-262	-336
19 15.5	+ 46.74	+ 71 07.8	+42 22 47.6	+0.67054	0.73983	+0.90635	-316	-286
9 56.0	- 97.91	-149 00.3	-35 19 16	-0.57499	0.81694	-0.70383	-349	+245
1 13.9	- 12.14	- 18 28.6	-33 56 02.5	-0.55507	0.83055	-0.66831	-354	+237
1 13.6	- 12.09	- 18 24.2	-33 56 05.1	-0.55509	0.83055	-0.66833	-354	+237
19 32.3	+ 43.98	+ 66 55.7	+10 30 24.3	+0.18118	0.98350	+0.18421	-420	- 77
0 33.2	- 5.46	- 8 18.7	+39 08 08.9	+0.62776	0.77670	+0.80825	-331	-268
23 49.2	+ 1.78	+ 2 42.1	+56 30 03.3	+0.83023	0.55322	+1.50073	-236	-354
0 50.6	- 8.31	- 12 39.1	+41 44 47.4	+0.66239	0.74726	+0.88642	-319	-283
1 00.3	- 9.91	- 15 05.1	+37 30 13.3	+0.60548	0.79431	+0.76227	-339	-258
18 45.9	+ 51.60	+ 78 31.3	+38 02 01.2	+0.61279	0.78869	+0.77697	-336	-261
18 22.3	+ 55.47	+ 84 25.3	+39 08 19.8	+0.62782	0.77669	+0.80833	-331	-268
16 09.2	+ 77.35	+117 42.7	+34 05 34.0	+0.55739	0.82905	+0.67232	-354	-238
23 59.8	+ 0.03	+ 0 02.7	+53 33 21.6	+0.80077	0.59533	+1.34508	-254	-342
18 33.7	+ 53.60	+ 81 34.1	+41 32 13.1	+0.65965	0.74967	+0.87992	-320	-281
23 26.3	+ 5.54	+ 8 25.8	+40 12 24.5	+0.64212	0.76480	+0.83959	-326	-274
18 35.9	+ 53.24	+ 81 01.6	+33 59 46.7	+0.55597	0.82996	+0.66988	-354	-237
18 28.0	+ 54.55	+ 83 00.7	+39 59 50.4	+0.63934	0.76717	+0.83338	-327	-273
0 50.3	- 8.26	- 12 34.7	+55 41 12.6	+0.82231	0.56501	+1.45537	-241	-351
0 50.2	- 8.24	- 12 32.3	+55 41 19.2	+0.82232	0.56499	+1.45547	-241	-351
0 49.8	- 8.18	- 12 27.2	+55 42 13	+0.82247	0.56477	+1.45629	-241	-351
0 50.0	- 8.22	- 12 30.3	+55 40 10	+0.82213	0.56526	+1.45442	-241	-351
0 50.1	- 8.23	- 12 31.6	+55 41 38	+0.82237	0.56491	+1.45576	-241	-351
0 50.2	- 8.25	- 12 33.2	+55 40 46	+0.82223	0.56512	+1.45497	-241	-351
19 43.2	+ 42.18	+ 64 11.8	-31 25 16.4	-0.51833	0.85420	-0.60680	-364	+221
1 19.8	- 13.12	- 19 57.6	+50 03 52.0	+0.76315	0.64322	+1.18645	-274	-326
1 14.6	- 12.26	- 18 39.1	+54 21 37.9	+0.80904	0.58398	+1.38538	-249	-345
18 22.8	+ 55.39	+ 84 17.7	+33 55 54.5	+0.55506	0.83061	+0.66825	-354	-237
5 12.2	- 51.29	- 78 02.9	+30 18 51.8	+0.50184	0.86410	+0.58076	-369	-214
18 27.8	+ 54.58	+ 83 03.3	+40 15 04	+0.64273	0.76433	+0.84090	-326	-274
17 00.2	+ 68.96	+104 56.9	+39 40 36.4	+0.63520	0.77091	+0.82396	-329	-271
17 45.3	+ 61.56	+ 93 41.2	+41 35 40	+0.66040	0.74901	+0.88170	-320	-282
0 18.6	- 3.05	- 4 38.5	+52 26 56.8	+0.78915	0.61076	+1.29209	-261	-337
23 34.6	+ 4.16	+ 6 20.3	+53 23 13.1	+0.79903	0.59771	+1.33681	-255	-341
11 22.0	-112.03	-170 29.5	-45 52 25.9	-0.71424	0.69746	-1.02405	-298	+305
11 22.0	-112.03	-170 29.8	-45 52 34	-0.71427	0.69744	-1.02413	-298	+305
23 47.3	+ 2.09	+ 3 11.0	+55 55 30	+0.82466	0.56159	+1.46844	-240	-352
18 09.3	+ 57.61	+ 87 40.5	+42 03 27.2	+0.66640	0.74361	+0.89616	-317	-284

If the horizontal parallax, $\pi=8''.80$ /distance, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{xy} \cos \theta$, $\Delta Y = \Delta_{xy} \sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Faenza, Italy	Urania Lamonia Observatory	51	-0	47	30.9
Fayette, Missouri	Morrison Observatory, since 1936	232	+6	10	48.00
Flagstaff, Arizona	Branch of United States Naval Obs.	2310	+7	27	02.1 b
Flagstaff, Arizona	Lowell Observatory	2210	+7	26	44.6 a
Fort Davis, Texas	McDonald Obs., University of Texas	2081	+6	56	05.36
Frederickton, New Brunswick	Obs. of the Univ. of New Brunswick	40	+4	26	34
Gaithersburg, Maryland	International Latitude Observatory	155	+5	08	47.8 d
Geneva, New York	Smith Observatory	152	+5	08	01.00
Geneva, Switzerland	Municipal Observatory	407	-0	24	36.61 c
Genoa, Italy	Hydrographic Institute	105	-0	35	41.28 c
Gorki, R. S. F. S. R.	Latitude Station	163	-2	55	56
Göttingen, Germany	University Observatory	161	-0	39	46.22
Greencastle, Indiana	McKim Obs., De Pauw University	262	+5	47	24.36 c
Greenwich, England	Royal Observatory	47	0	00	00.00 c
Groningen, Netherlands	Kapteyn Astronomical Laboratory	4	-0	26	15.11
Groningen, Netherlands	Observatory of M. Schmidt	—	-0	26	13.44
Haarlem, Netherlands	Observatory of B. J. M. Walker	0	-0	18	35.47
Hamburg, Germany	German Hydrographic Institute	30	-0	39	53.44 c
Hamburg, Germany	Hamburg Observatory, at Bergedorf	41	-0	40	57.74 c
Hanover, Germany	Geodetic Institute	50	-0	38	51.3
Hanover, Germany	Obs. of Hanover Astronomical Society	50	-0	39	00.8
Hanover, New Hampshire	Shattuck Obs., Dartmouth College	183	+4	49	08.02
Hardenberg, Netherlands	Observatory of D. G. H. Kenskamp	15	-0	26	28.23 a
Harderwijk, Netherlands	Observatory of J. van Raalten	2	-0	22	28.52 b
Hartebeespoort, South Africa	Union Observatory Annexe	1220	-1	51	30.44 a
Harvard, Massachusetts	George R. Agassiz Sta. of Harvard Obs.	183	+4	46	14.2
Haverford, Pennsylvania	Strawbridge Mem. Obs., Haverford Coll.	116	+5	01	12.70 d
Heidelberg, Germany	State Observatory, at Königstuhl	570	-0	34	53.19 c
Helsingör, Denmark	Observatory of R. Fr. Rasmussen	—	-0	50	25.6
Helsinki, Finland	University Observatory	33	-1	39	49.10 c
Helsinki, Finland	Ursa Observatory	25	-1	39	50.09
Helsinki, Finland	Observatory of Institute of Technology	38	-1	39	44.30
Helwan, Egypt	Helwan Observatory	115	-2	05	21.87
Herstmonceux, Sussex	Royal Greenwich Observatory	34	-0	01	21.03 c
Hoher List, Germany	Hoher List Obs. of Bonn University	541	-0	27	23.9
Hoorn, Netherlands	Observatory of J. C. van der Meulen	—	-0	20	12.90 b
Huittinen, Finland	Observatory of Mr. Jaakola	58	-1	30	39.00
Hyderabad, India	Nizamiah Observatory	554	-5	13	48.98
Iowa City, Iowa	Observatory, University of Iowa	221	+6	06	08
Ipswich, Suffolk	Obs. of Ipswich Astronomical Society	37	-0	04	44.8 a
Irkutsk, R. S. F. S. R.	Astronomical Obs. of State University	468	-6	57	22.71 c
Irkutsk, R. S. F. S. R.	City Astronomical Observatory	432	-6	57	07.1
Istanbul, Turkey	University Observatory	65	-1	55	52
Ithaca, New York	Fuertes Obs. of Cornell University	270	+5	05	54.3 a
Jakarta, Indonesia	International Latitude Observatory	23	-7	07	32 d

a Equatorial refractor b Equatorial reflector c Transit or meridian circle d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx_y	ΔZ
h m	s	° '	° ' "					
0 47.5	- 7.81	- 11 52.7	+44 17 14	+0.69471	0.71703	+0.96886	-306	-296
17 49.2	+60.91	+ 92 42.0	+39 09 00.0	+0.62797	0.77657	+0.80865	-331	-268
16 33.0	+73.44	+111 45.5	+35 11 28	+0.57328	0.81844	+0.70045	-349	-244
16 33.3	+73.39	+111 41.1	+35 12 30.5	+0.57352	0.81826	+0.70090	-349	-245
17 03.9	+68.35	+104 01.3	+30 40 17.0	+0.50729	0.86114	+0.58909	-367	-216
19 33.4	+43.79	+ 66 38.5	+45 57.0	+0.71515	0.69650	+1.02677	-297	-305
18 51.2	+50.73	+ 77 11.9	+39 08 13.2	+0.62779	0.77670	+0.80828	-331	-268
18 52.0	+50.60	+ 77 00.3	+42 52 46.2	+0.67696	0.73395	+0.92235	-313	-289
0 24.6	- 4.04	- 6 09.2	+46 11 59.3	+0.71821	0.69340	+1.03577	-296	-306
0 35.7	- 5.86	- 8 55.3	+44 25 09.3	+0.69636	0.71542	+0.97334	-305	-297
2 55.9	-28.90	- 43 59.0	+56 15 32	+0.82791	0.55675	+1.48704	-238	-353
0 39.8	- 6.53	- 9 56.6	+51 31 48.2	+0.77930	0.62341	+1.25007	-266	-332
18 12.6	+57.07	+ 86 51.1	+39 38 46.6	+0.63465	0.77109	+0.82306	-329	-271
0 00.0	0.00	0 00.0	+51 28 38.2	+0.77871	0.62411	+1.24770	-266	-332
0 26.3	- 4.31	- 6 33.8	+53 13 13.8	+0.79728	0.60003	+1.32873	-256	-340
0 26.2	- 4.31	- 6 33.4	+53 12 46.4	+0.79720	0.60014	+1.32836	-256	-340
0 18.6	- 3.05	- 4 38.9	+52 23 59.4	+0.78863	0.61144	+1.28979	-261	-336
0 39.9	- 6.55	- 9 58.4	+53 32 51.2	+0.80069	0.59546	+1.34467	-254	-342
0 41.0	- 6.73	- 10 14.4	+53 28 46.9	+0.79999	0.59641	+1.34134	-254	-341
0 38.9	- 6.38	- 9 42.8	+52 23 13	+0.78850	0.61162	+1.28919	-261	-336
0 39.0	- 6.41	- 9 45.2	+52 24 36	+0.78874	0.61130	+1.29026	-261	-337
19 10.9	+47.50	+ 72 17.0	+43 42 15.3	+0.68742	0.72410	+0.94934	-309	-293
0 26.5	- 4.35	- 6 37.1	+52 34 24.1	+0.79047	0.60904	+1.29790	-260	-337
0 22.5	- 3.69	- 5 37.1	+52 20 36.7	+0.78803	0.61222	+1.28717	-261	-336
1 51.5	-18.32	- 27 52.6	-25 46 22.4	-0.43224	0.90127	-0.47959	-385	+184
19 13.8	+47.02	+ 71 33.5	+42 30 13	+0.67215	0.73839	+0.91029	-315	-287
18 58.8	+49.48	+ 75 18.2	+40 00 40.1	+0.63952	0.76700	+0.83379	-327	-273
0 34.9	- 5.73	- 8 43.3	+49 23 54.6	+0.75568	0.65212	+1.15882	-278	-322
0 50.4	- 8.28	- 12 36.4	+56 02 22	+0.82576	0.55992	+1.47478	-239	-352
1 39.8	-16.40	- 24 57.3	+60 09 42.3	+0.86379	0.49882	+1.73168	-213	-369
1 39.8	-16.40	- 24 57.5	+60 09 20	+0.86374	0.49891	+1.73124	-213	-369
1 39.7	-16.38	- 24 56.1	+60 09 48	+0.86381	0.49880	+1.73179	-213	-369
2 05.4	-20.59	- 31 20.5	+29 51 31.1	+0.49494	0.86800	+0.57021	-370	-211
0 01.4	- 0.22	- 0 20.3	+50 52 18	+0.77209	0.63234	+1.22099	-270	-329
0 27.4	- 4.50	- 6 51.0	+50 09 47.1	+0.76429	0.64193	+1.19061	-274	-326
0 20.2	- 3.32	- 5 03.2	+52 38 38.4	+0.79122	0.60806	+1.30122	-259	-338
1 30.6	-14.89	- 22 39.7	+61 07 40	+0.87207	0.48411	+1.80138	-207	-372
5 13.8	-51.55	- 78 27.2	+17 25 54.3	+0.29767	0.95445	+0.31188	-407	-127
17 53.9	+60.15	+ 91 32.0	+41 39 44	+0.66128	0.74822	+0.88380	-319	-282
0 04.7	- 0.78	- 1 11.2	+52 02 16.3	+0.78476	0.61643	+1.27307	-263	-335
6 57.4	-68.56	-104 20.7	+52 16 44.4	+0.78740	0.61315	+1.28418	-262	-336
6 57.1	-68.52	-104 16.8	+52 16 27	+0.78734	0.61322	+1.28395	-262	-336
1 55.9	-19.03	- 28 58.0	+41 00 45	+0.65277	0.75567	+0.86382	-322	-278
18 54.1	+50.25	+ 76 28.6	+42 27 10.4	+0.67150	0.73900	+0.90867	-315	-286
7 07.5	-70.23	-106 53.0	- 6 15 38.5	-0.10832	0.99408	-0.10897	-424	+ 46

If the horizontal parallax, $\pi=8''.80$ /distance, is known the parallax corrections are:

$$\Delta\alpha=\pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta=\pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h=\theta-\alpha$ and θ =sidereal time at 0^h+sidereal equivalent of U.T.- λ

Otherwise add $\Delta X=\Delta x_y \cos \theta$, $\Delta Y=\Delta x_y \sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Jena, Germany	University Observatory	164	-0 46 20.22 a
Johannesburg, South Africa . . .	Union Observatory	1806	-1 52 18.0
Johannesburg, South Africa . . .	Branch of Yale University Observatory	1741	-1 52 07 a
Juvisy, France	M. Flammarion's Observatory	95	-0 09 29.0
Kalocsa, Hungary	Archiepiscopal Haynald Observatory	177	-1 15 54.12 c
Karlsruhe, Germany	Observatory of W. Malsch	128	-0 33 32.51
Kazan, R. S. F. S. R.	Engelhardt Observatory	98	-3 15 15.74 c
Kazan, R. S. F. S. R.	Astronomical Obs. of State University	79	-3 16 29.03
Kharkov, Ukrainian S. S. R. . . .	Astronomical Obs. of State University	138	-2 24 55.72 c
Kiev, Ukrainian S. S. R.	Astronomical Obs. of State University	184	-2 02 00.56 c
Kitab, Uzbek S. S. R.	International Latitude Observatory	658	-4 27 31.7 d
Kodaikanal, India	Solar Physics Observatory	2343	-5 09 52.47
Königsberg, Germany	University Observatory	24	-1 21 58.97 c
Kremsmünster, Austria	Observatory of the Benedictines	384	-0 56 31.58 c
Ksara, Syria	Ksara Observatory, near Beirut	923	-2 23 33.77
Kunming, China	National Institute of Astronomy	1940	-6 51 09.2
Kyoto, Japan	Kwasan Observatory	234	-9 03 10.40 a
Lake Angelus, Michigan	McMath-Hulbert Observatory ¹	296	+5 33 03.3
La Plata, Argentina	National University Observatory	17	+3 51 43.72 c
Larchmont, New York	Observatory of W. Stevens	15	+4 55 00.6
Leiden, Netherlands	University Observatory	6	-0 17 56.15 c
Leiden, Netherlands	Observatory of J. F. M. Bruijn	—	-0 17 59.26
Leipzig, Germany	University Observatory, since 1861	119	-0 49 33.92
Lembang, Indonesia	Bosscha Observatory	1300	-7 10 27.84
Leningrad, R. S. F. S. R.	Astronomical Obs. of State University	3	-2 01 10.71 c
Liège, Belgium	University Observatory, Cointe	127	-0 22 15.44
Lisbon, Portugal	Lisbon Observatory, at Tapada	95	+0 36 44.68 a
Lisbon, Portugal	Observatory of Faculty of Sciences	77	+0 36 35.61
Liverpool, England	Bidston, Birkenhead, since 1867	61	+0 12 17.33
Louisville, Kentucky	Observatory of University of Louisville	152	+5 43 02.4 b
Lund, Sweden	Royal University Observatory	34	-0 52 44.97
Lvov, Ukrainian S. S. R.	Astronomical Institute of the University	330	-1 36 07.13
Lvov, Ukrainian S. S. R.	Observatory of the Polytechnic Institute	340	-1 36 03.40 c
Lyons, France	University Observatory	299	-0 19 08.52 c
Madison, Wisconsin	Washburn Obs., University of Wisconsin	292	+5 57 37.90 c
Madras, India	Observatory founded by East India Co.	7	-5 20 59.14
Madrid, Spain	Astronomical Observatory	655	+0 14 45.10
Mamaroneck, New York	Observatory of E. A. Sill	—	+4 54 56.33 a
Marseilles, France	National Observatory, at Longchamp	75	-0 21 34.55 c
Meudon, France	Observatory of Physical Astronomy	162	-0 08 55.5
Middletown, Connecticut	Van Vleck Obs., Wesleyan University	65	+4 50 38.2 a
Milan, Italy	Brera Observatory	120	-0 36 45.89 a
Mill Hill, London	Observatory of University of London	82	+0 00 57.77
Minneapolis, Minnesota	Observatory of University of Minnesota	260	+6 12 57.04 c
Mizusawa, Japan	International Latitude Observatory	61	-9 24 31.46 d

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Branch of the Observatory of the University of Michigan

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx_y	ΔZ
h m	s	° '	° ' "					
0 46.3	- 7.61	- 11 35.1	+50 55 35.6	+0.77271	0.63161	+1.22339	-269	-330
1 52.3	-18.45	- 28 04.5	-26 10 55.3	-0.43867	0.89824	-0.48837	-383	+187
1 52.1	-18.42	- 28 01.7	-26 11 14	-0.43875	0.89819	-0.48848	-383	+187
0 09.5	- 1.56	- 2 22.3	+48 41 37	+0.74757	0.66135	+1.13037	-282	-319
1 15.9	-12.47	- 18 58.5	+46 31 41.7	+0.72213	0.68923	+1.04773	-294	-308
0 33.5	- 5.51	- 8 23.1	+49 01 26.6	+0.75137	0.65701	+1.14360	-280	-321
3 15.3	-32.08	- 48 48.9	+55 50 20.2	+0.82381	0.56283	+1.46370	-240	-351
3 16.5	-32.28	- 49 07.3	+55 47 23.9	+0.82333	0.56353	+1.46102	-240	-351
2 24.9	-23.81	- 36 13.9	+50 00 09.9	+0.76245	0.64404	+1.18386	-275	-325
2 02.0	-20.04	- 30 30.1	+50 27 11.8	+0.76748	0.63800	+1.20296	-272	-327
4 27.5	-43.95	- 66 52.9	+39 08 01.7	+0.62780	0.77680	+0.80819	-331	-268
5 09.9	-50.90	- 77 28.1	+10 13 50	+0.17650	0.98457	+0.17927	-420	- 75
1 22.0	-13.47	- 20 29.7	+54 42 50.5	+0.81262	0.57896	+1.40358	-247	-347
0 56.5	- 9.29	- 14 07.9	+48 03 23.1	+0.74023	0.66968	+1.10533	-286	-316
2 23.6	-23.58	- 35 53.4	+33 49 25.6	+0.55356	0.83174	+0.66554	-355	-236
6 51.2	-67.54	-102 47.3	+25 01 32.0	+0.42056	0.90694	+0.46371	-387	-179
9 03.2	-89.23	-135 47.6	+34 59 40.8	+0.57030	0.82014	+0.69536	-350	-243
18 26.9	+54.71	+ 83 15.8	+42 39 47.7	+0.67420	0.73652	+0.91539	-314	-288
20 08.3	+38.07	+ 57 55.9	-34 54 30.3	-0.56905	0.82097	-0.69314	-350	+243
19 05.0	+48.46	+ 73 45.1	+40 56 12	+0.65176	0.75653	+0.86152	-323	-278
0 17.9	- 2.95	- 4 29.0	+52 09 19.8	+0.78602	0.61481	+1.27847	-262	-335
0 18.0	- 2.96	- 4 29.8	+52 08 49.1	+0.78593	0.61493	+1.27808	-262	-335
0 49.6	- 8.14	- 12 23.5	+51 20 05.9	+0.77717	0.62606	+1.24136	-267	-332
7 10.5	-70.71	-107 37.0	- 6 49 32.9	-0.11808	0.99316	-0.11889	-424	+ 50
2 01.2	-19.91	- 30 17.7	+59 56 32.2	+0.86188	0.50214	+1.71641	-214	-368
0 22.3	- 3.66	- 5 33.9	+50 37 06	+0.76930	0.63577	+1.21002	-271	-328
23 23.3	+ 6.04	+ 9 11.2	+38 42 30.7	+0.62198	0.78138	+0.79601	-333	-265
23 23.4	+ 6.01	+ 9 08.9	+38 43 03.5	+0.62210	0.78128	+0.79627	-333	-265
23 47.7	+ 2.02	+ 3 04.3	+53 24 04.8	+0.79918	0.59751	+1.33751	-255	-341
18 17.0	+56.35	+ 85 45.6	+38 12 50	+0.61525	0.78674	+0.78202	-336	-262
0 52.7	- 8.67	- 13 11.2	+55 41 51.6	+0.82241	0.56486	+1.45596	-241	-351
1 36.1	-15.79	- 24 01.8	+49 49 57.6	+0.76056	0.64632	+1.17675	-276	-324
1 36.1	-15.78	- 24 00.8	+49 50 11.2	+0.76060	0.64628	+1.17690	-276	-325
0 19.1	- 3.14	- 4 47.1	+45 41 41.0	+0.71208	0.69972	+1.01766	-299	-304
18 02.4	+58.75	+ 89 24.5	+43 04 36.8	+0.67949	0.73162	+0.92874	-312	-290
5 21.0	-52.73	- 80 14.8	+13 04 08.0	+0.22464	0.97427	+0.23057	-416	- 96
23 45.2	+ 2.42	+ 3 41.3	+40 24 30.0	+0.64485	0.76260	+0.84560	-325	-275
19 05.1	+48.45	+ 73 44.1	+40 56 30.1	+0.65183	0.75647	+0.86167	-323	-278
0 21.6	- 3.54	- 5 23.6	+43 18 16.3	+0.68235	0.72888	+0.93616	-311	-291
0 08.9	- 1.47	- 2 13.9	+48 48 18	+0.74886	0.65990	+1.13481	-282	-319
19 09.4	+47.74	+ 72 39.5	+41 33 18	+0.65986	0.74944	+0.88048	-320	-282
0 36.8	- 6.04	- 9 11.5	+45 27 59.2	+0.70927	0.70254	+1.00958	-300	-303
23 59.0	+ 0.16	+ 0 14.4	+51 36 46.3	+0.78019	0.62227	+1.25378	-265	-333
17 47.0	+61.27	+ 93 14.3	+44 58 40.0	+0.70329	0.70860	+0.99251	-302	-300
9 24.5	-92.74	-141 07.9	+39 08 03.4	+0.62774	0.77672	+0.80820	-331	-268

If the horizontal parallax, $\pi=8''.80$ /distance, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta x_y \cos \theta$, $\Delta Y = \Delta x_y \sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Modena, Italy	Royal University Geophysical Obs.	64	-	0 43	43.40
Montevideo, Uruguay	National Observatory	24	+	3 44	51
Montreal, Quebec	McGill University Observatory	57	+	4 54	18.63 c
Montreal, Quebec	Ville-Marie Observatory	69	+	4 54	29.2
Moscow, R. S. F. S. R.	Obs. of Sternberg Inst. of University	166	-	2 30	16.95 c
Mount Hamilton, California . . .	Lick Obs., University of California	1283	+	8 06	34.93 c
Mount Palomar, California . . .	Palomar Observatory ¹	1706	+	7 47	27.36 b
Mount Wilson, California . . .	Observatory of Carnegie Institution	1742	+	7 52	14.33 b
Mount Wilson, California . . .	Branch of Smithsonian Astro. Obs.	1675	+	7 52	14.3
Munich, Germany	University Observatory	529	-	0 46	26.02
Nanking, China	Purple Mountain Observatory	367	-	7 55	17.02
Nantucket, Massachusetts . . .	Maria Mitchell Observatory	20	+	4 40	25.15 a
Naples, Italy	Astronomical Obs., at Capodimonte	164	-	0 57	01.41 a
Nashville, Tennessee	Arthur J. Dyer Obs., Vanderbilt Univ.	345	+	5 47	13.27 b
Neuchâtel, Switzerland	Cantonal Observatory	488	-	0 27	49.79 c
New Haven, Connecticut	Yale University Observatory	40	+	4 51	40.58
New Plymouth, New Zealand . . .	Obs. of New Plymouth Astronomical Soc.	49	-	11 36	17.77 a
New York, New York	Columbia University Observatory	25	+	4 55	50
Nice, France	Nice Observatory, at Mont Gros	376	-	0 29	12.10 c
Nikolaev, Ukrainia	Astronomical Observatory	54	-	2 07	53.92 c
Norman, Oklahoma	Observatory of University of Oklahoma	363	+	6 29	46.48
Northampton, Massachusetts . .	Smith College Observatory	70	+	4 50	33.10 c
Northfield, Minnesota	Goodsell Observatory	290	+	6 12	35.92 c
Nuth, Netherlands	Observatory of J. Muijtjens	—	-	0 23	33.3
Oakland, California	Chabot Observatory	99	+	8 08	48
Odessa, Ukrainian S. S. R. . . .	Odessa Observatory	53	-	2 03	01.98
Ondřejov, Czechoslovakia . . .	Astrophysical Observatory	533	-	0 59	08.08
Orono, Maine	Observatory of University of Maine	38	+	4 34	40.3
Oslo, Norway	University Observatory	25	-	0 42	53.5 c
Ottawa, Ontario	Dominion Observatory	87	+	5 02	51.95 c
Oxford, England	University Observatory	64	+	0 05	00.4 c
Oxford, Mississippi	Obs. of University of Mississippi	161	+	5 58	07.18
Padua, Italy	Astronomical Observatory	38	-	0 47	29.15
Palermo, Sicily	University Astronomical Observatory	72	-	0 53	25.87
Palo Alto, California	Observatory of H. Power	10	+	8 08	35.04
Paris, France	Observatory of Paris ²	67	-	0 09	20.91 c
Perth, Western Australia	Government Observatory	65	-	7 43	21.62 a
Philadelphia, Pennsylvania . . .	Flower and Cook Obs., Univ. of Pa.	155	+	5 01	54.33 b
Philadelphia, Pennsylvania . . .	Student's Obs., Univ. of Pennsylvania	21	+	5 00	44
Philadelphia, Pennsylvania . . .	Franklin Institute Observatory	30	+	5 00	41.6 a
Pic du Midi, France	Observatory of University of Toulouse	2862	-	0 00	34.16 a
Pittsburgh, Pennsylvania	Allegheny Obs. of the University	370	+	5 20	05.34 a
Pola, Italy	Observatory of Hydrographic Office	32	-	0 55	23.07 c
Poltava, Ukrainian S. S. R. . . .	Gravimetric Observatory	151	-	2 18	11.2
Portage Lake, Michigan	Portage Lake Observatory ³	321	+	5 35	41.93 b

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Of Carnegie Institution of Washington and California Institute of Technology² Cassini's Meridian³ Branch of the Observatory of University of Michigan

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx_y	ΔZ
h m	s	° ' "	° ' "					
0 43.7	- 7.18	- 10 55.9	+44 38 51.4	+0.69919	0.71263	+0.98113	-304	-298
20 15.2	+ 36.94	+ 56 12.7	-34 54 33	-0.56906	0.82097	-0.69316	-350	+243
19 05.7	+ 48.35	+ 73 34.7	+45 30 20	+0.70974	0.70205	+1.01096	-300	-303
19 05.5	+ 48.38	+ 73 37.3	+45 28 22	+0.70934	0.70246	+1.00981	-300	-303
2 30.3	- 24.69	- 37 34.2	+55 45 19.8	+0.82300	0.56404	+1.45912	-241	-351
15 53.4	+ 79.93	+121 38.7	+37 20 25.3	+0.60334	0.79619	+0.75778	-340	-257
16 12.5	+ 76.79	+116 51.8	+33 21 22.4	+0.54685	0.83635	+0.65386	-357	-233
16 07.8	+ 77.58	+118 03.6	+34 12 59.5	+0.55929	0.82802	+0.67545	-353	-239
16 07.8	+ 77.58	+118 03.6	+34 12 55	+0.55927	0.82803	+0.67542	-353	-239
0 46.4	- 7.63	- 11 36.5	+48 08 45.5	+0.74129	0.66854	+1.10882	-285	-316
7 55.3	- 78.08	-118 49.3	+32 03 59.9	+0.52787	0.84828	+0.62228	-362	-225
19 19.6	+ 46.07	+ 70 06.3	+41 16 50	+0.65627	0.75259	+0.87202	-321	-280
0 57.0	- 9.37	- 14 15.4	+40 51 45.7	+0.65080	0.75739	+0.85927	-323	-278
18 12.8	+ 57.04	+ 86 48.3	+36 03 08.5	+0.58528	0.80947	+0.72305	-345	-250
0 27.8	- 4.57	- 6 57.4	+46 59 50.6	+0.72777	0.68331	+1.06506	-292	-310
19 08.3	+ 47.92	+ 72 55.1	+41 19 22.3	+0.65683	0.75211	+0.87332	-321	-280
11 36.3	-114.38	-174 04.4	-39 03 45.2	-0.62677	0.77750	-0.80614	-332	+267
19 04.2	+ 48.60	+ 73 57.5	+40 48 34.6	+0.65009	0.75798	+0.85766	-323	-277
0 29.2	- 4.80	- 7 18.0	+43 43 17.0	+0.68765	0.72392	+0.94990	-309	-293
2 07.9	- 21.01	- 31 58.5	+46 58 18.5	+0.72742	0.68359	+1.06411	-292	-310
17 30.2	+ 64.03	+ 97 26.6	+35 12 08.3	+0.57326	0.81808	+0.70074	-349	-245
19 09.4	+ 47.73	+ 72 38.3	+42 19 01.9	+0.66974	0.74057	+0.90436	-316	-286
17 47.4	+ 61.21	+ 93 09.0	+44 27 41.6	+0.69690	0.71493	+0.97478	-305	-297
0 23.6	- 3.87	- 5 53.3	+50 55 15.4	+0.77262	0.63167	+1.22314	-269	-330
15 51.2	+ 80.30	+122 12.0	+37 47 00	+0.60934	0.79134	+0.77000	-338	-260
2 03.0	- 20.21	- 30 45.5	+46 28 37.5	+0.72151	0.68987	+1.04586	-294	-308
0 59.1	- 9.71	- 14 47.0	+49 54 38.1	+0.76146	0.64531	+1.18000	-275	-325
19 25.3	+ 45.12	+ 68 40.1	+44 54 00	+0.70231	0.70953	+0.98982	-303	-300
0 42.9	- 7.05	- 10 43.4	+59 54 43.7	+0.86162	0.50260	+1.71433	-214	-368
18 57.1	+ 49.75	+ 75 43.0	+45 23 38.1	+0.70838	0.70344	+1.00703	-300	-302
23 55.0	+ 0.82	+ 1 15.1	+51 45 34.2	+0.78177	0.62026	+1.26040	-265	-334
18 01.9	+ 58.83	+ 89 31.8	+34 22 12.6	+0.56136	0.82631	+0.67935	-353	-239
0 47.5	- 7.80	- 11 52.3	+45 24 01.3	+0.70846	0.70335	+1.00726	-300	-302
0 53.4	- 8.78	- 13 21.5	+38 06 43.6	+0.61385	0.78782	+0.77917	-336	-262
15 51.4	+ 80.26	+122 08.8	+37 26 18.4	+0.60457	0.79500	+0.76047	-339	-258
0 09.3	- 1.54	- 2 20.2	+48 50 11	+0.74921	0.65948	+1.13607	-281	-320
7 43.4	- 76.12	-115 50.4	-31 57 10.7	-0.52617	0.84929	-0.61954	-362	+224
18 58.1	+ 49.60	+ 75 28.6	+39 59 57	+0.63936	0.76714	+0.83343	-327	-273
18 59.3	+ 49.40	+ 75 11.0	+39 57	+0.63869	0.76767	+0.83198	-328	-272
18 59.3	+ 49.40	+ 75 10.4	+39 57 27.6	+0.63879	0.76759	+0.83221	-327	-273
0 00.6	- 0.09	- 0 08.5	+42 56 12.0	+0.67797	0.73358	+0.92420	-313	-289
18 39.9	+ 52.58	+ 80 01.3	+40 28 58.1	+0.64581	0.76173	+0.84782	-325	-276
0 55.4	- 9.10	- 13 50.8	+44 51 48.6	+0.70186	0.70998	+0.98856	-303	-299
2 18.2	- 22.70	- 34 32.8	+49 36 13.0	+0.75796	0.64935	+1.16725	-277	-323
18 24.3	+ 55.15	+ 83 55.5	+42 24 10.7	+0.67087	0.73959	+0.90708	-316	-286

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and $\theta = \text{sidereal time at } 0^h + \text{sidereal equivalent of U.T.} - \lambda$

Otherwise add $\Delta X = \Delta x_y \cos \theta$, $\Delta Y = \Delta x_y \sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Portland, Oregon	Observatory of R. E. Millard	213	+	8 10	48.2
Potsdam, Germany	Astrophysical Observatory	107	-	0 52	15.86 a
Potsdam, Germany	Geodetic Institute ¹	109	-	0 52	16.11
Poughkeepsie, New York	Vassar College Observatory	61	+	4 55	35.16 c
Poznań, Poland	University Observatory	85	-	1 07	30.78 a
Prague, Czechoslovakia	Stefánik Observatory	327	-	0 57	35.8
Prague, Czechoslovakia	Astronomical Institute of Charles Univ.	267	-	0 57	35.1
Prague, Czechoslovakia	Technical University Observatory	237	-	0 57	40.92
Prague, Czechoslovakia	Observatory of K. Novak	218	-	0 57	38.04 a
Pretoria, South Africa	Radcliffe Observatory	1542	-	1 52	54.9 b
Pretoria, South Africa	Observatory of S. C. Venter	1268	-	1 52	52.7
Princeton, New Jersey	Princeton University Observatory	43	+	4 58	35.59
Princeton, New Jersey	Obs. of Instruction, Princeton Univ.	65	+	4 58	37.61 c
Providence, Rhode Island	Ladd Observatory, Brown University	69	+	4 45	35.95 a
Pulkovo, R. S. F. S. R.	Astronomical Obs. of Acad. of Sciences	75	-	2 01	18.57
Quebec, Canada	Quebec Observatory, Plains of Abraham	90	+	4 44	52.71 c
Quito, Ecuador	National Observatory	2908	+	5 13	58.20
Rarotonga, Cook Islands	Observatory of F. M. Bateson	—	+	10 39	06.3 a
Reutlingen, Germany	Popular Observatory	401	-	0 36	49.11
Richmond, Florida	Branch of United States Naval Obs.	—	+	5 21	31.3 d
Richmond Hill, Ontario	David Dunlap Obs., Univ. of Toronto	244	+	5 17	41.3
Riga, Latvia	Polytechnic School Observatory	—	-	1 36	28.10
Rio de Janeiro, Brazil	National Observatory	33	+	2 52	53.5 c
Rome, Italy	Rome Observatory, on Monte Mario	152	-	0 49	48.55 c
Rome, Italy	Royal University Obs. at Capitol	65	-	0 49	56.34 c
St. Louis, Missouri	Washington University Observatory	178	+	6 01	13.3
San Fernando, Spain	Naval Observatory	30	+	0 24	49.30
Santa Clara, California	Obs. of University of Santa Clara	31	+	8 07	48
Santiago, Chile	National Observatory, at San Bernardo	580	+	4 42	45.09 c
Sendai, Japan	Tohoku University Observatory	36	-	9 23	29.49
Sidmouth, Devon	Norman Lockyer Observatory	171	+	0 12	52.5 a
Simeis, Crimea, R. S. F. S. R.	Crimean Astrophysical Observatory	346	-	2 15	59.38
Skalná Pleso, Czechoslovakia	Astronomical Observatory	1783	-	1 20	58.8 b
Sonneberg, Germany	Sonneberg Observatory	640	-	0 44	46.19 a
South Bethlehem, Pennsylvania	Sayre Observatory, Lehigh University	110	+	5 01	31.96 a
South Hadley, Massachusetts	Williston Obs., Mount Holyoke Coll.	76	+	4 50	18.99 a
Springfield, Vermont	Turret Observatory of Mrs. Beardsley	171	+	4 49	55
Stalinabad, Tadjik S. S. R.	Astronomical Obs. of Acad. of Sciences	820	-	4 35	07.47
Stockholm, Sweden	Stockholm Observatory, at Saltsjöbaden	55	-	1 13	14 c
Strasbourg, France	University Observatory	156	-	0 31	04.25 a
Stuttgart, Germany	Swabian Observatory	344	-	0 36	47.39
Sunspot, New Mexico	Sacramento Peak Observatory	2811	+	7 03	16.6
Swarthmore, Pennsylvania	Sproul Observatory, Swarthmore College	63	+	5 01	25.62 a
Sydney, New South Wales	Government Observatory	44	-	10 04	49.19
Sydney, New South Wales	Riverview College Observatory	26	-	10 04	37.99 a

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Helmert Tower; zero of the German triangulation

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{xy}	ΔZ
h m	s	° '	° ' "					
15 49.2	+ 80.63	+122 42.0	+45 29 43.7	+0.70965	0.70220	+1.01061	-300	-303
0 52.3	- 8.59	- 13 04.0	+52 22 56.0	+0.78845	0.61169	+1.28897	-261	-336
0 52.3	- 8.59	- 13 04.0	+52 22 54.8	+0.78845	0.61170	+1.28895	-261	-336
19 04.4	+ 48.56	+ 73 53.8	+41 41 18	+0.66160	0.74789	+0.88461	-319	-282
1 07.5	- 11.09	- 16 52.7	+52 23 54.3	+0.78862	0.61147	+1.28972	-261	-336
0 57.6	- 9.46	- 14 23.9	+50 04 56	+0.76336	0.64299	+1.18720	-274	-326
0 57.6	- 9.46	- 14 23.8	+50 04 36.0	+0.76329	0.64306	+1.18696	-274	-326
0 57.7	- 9.48	- 14 25.2	+50 04 40.2	+0.76330	0.64304	+1.18701	-274	-326
0 57.6	- 9.47	- 14 24.5	+50 04 42.1	+0.76330	0.64303	+1.18703	-274	-326
1 52.9	- 18.55	- 28 13.7	-25 47 18	-0.43250	0.90120	-0.47992	-384	+185
1 52.9	- 18.54	- 28 13.2	-25 42 43	-0.43129	0.90174	-0.47829	-385	+184
19 01.4	+ 49.05	+ 74 38.9	+40 20 47.7	+0.64397	0.76322	+0.84375	-326	-275
19 01.4	+ 49.06	+ 74 39.4	+40 20 57.8	+0.64401	0.76320	+0.84383	-326	-275
19 14.4	+ 46.92	+ 71 24.0	+41 50 15.6	+0.66354	0.74616	+0.88927	-318	-283
2 01.3	- 19.93	- 30 19.6	+59 46 18.5	+0.86039	0.50472	+1.70469	-215	-367
19 15.1	+ 46.80	+ 71 13.2	+46 47 59.2	+0.72537	0.68579	+1.05772	-293	-309
18 46.0	+ 51.58	+ 78 29.6	- 0 14 00	-0.00405	1.00045	-0.00404	-427	+ 2
13 20.9	+104.99	+159 46.6	-21 12 17	-0.35943	0.93270	-0.38536	-398	+153
0 36.8	- 6.05	- 9 12.3	+48 29 25.9	+0.74527	0.66404	+1.12232	-283	-318
18 38.5	+ 52.82	+ 80 22.8	+25 37 28	+0.42983	0.90222	+0.47642	-385	-183
18 42.3	+ 52.19	+ 79 25.3	+43 51 46	+0.68942	0.72219	+0.95461	-308	-294
1 36.5	- 15.85	- 24 07.0	+56 57 09.3	+0.83456	0.54662	+1.52675	-233	-356
21 07.1	+ 28.40	+ 43 13.4	-22 53 42.2	-0.38663	0.92169	-0.41948	-393	+165
0 49.8	- 8.18	- 12 27.2	+41 55 19.2	+0.66464	0.74519	+0.89191	-318	-284
0 49.9	- 8.20	- 12 29.1	+41 53 33.6	+0.66425	0.74552	+0.89099	-318	-283
17 58.8	+ 59.34	+ 90 18.3	+38 38 57.0	+0.62118	0.78203	+0.79432	-334	-265
23 35.2	+ 4.08	+ 6 12.3	+36 27 42.0	+0.59100	0.80522	+0.73396	-344	-252
15 52.2	+ 80.13	+121 57.0	+37 20 45	+0.60329	0.79598	+0.75793	-340	-257
19 17.2	+ 46.45	+ 70 41.3	-33 33 44.2	-0.54974	0.83422	-0.65899	-356	+235
9 23.5	- 92.57	-140 52.4	+38 15 14.9	+0.61579	0.78629	+0.78315	-335	-263
23 47.1	+ 2.11	+ 3 13.1	+50 41 13.3	+0.77007	0.63485	+1.21299	-271	-329
2 16.0	- 22.34	- 33 59.8	+44 24 11.6	+0.69618	0.71565	+0.97280	-305	-297
1 21.0	- 13.30	- 20 14.7	+49 11 20.0	+0.75344	0.65501	+1.15027	-279	-321
0 44.8	- 7.35	- 11 11.5	+50 22 41.4	+0.76670	0.63906	+1.19974	-273	-327
18 58.5	+ 49.53	+ 75 23.0	+40 36 23.2	+0.64742	0.76029	+0.85154	-324	-276
19 09.7	+ 47.69	+ 72 34.7	+42 15 18.2	+0.66894	0.74130	+0.90239	-316	-285
19 10.1	+ 47.63	+ 72 28.7	+43 16 45	+0.68204	0.72919	+0.93534	-311	-291
4 35.1	- 45.20	- 68 46.9	+38 33 39.9	+0.62005	0.78307	+0.79182	-334	-265
1 13.2	- 12.03	- 18 18.5	+59 16 18	+0.85596	0.51225	+1.67099	-219	-365
0 31.1	- 5.10	- 7 46.1	+48 35 02.1	+0.74631	0.66279	+1.12601	-283	-318
0 36.8	- 6.04	- 9 11.8	+48 47 00.7	+0.74863	0.66020	+1.13395	-282	-319
16 56.7	+ 69.53	+105 49.2	+32 47 12	+0.53864	0.84189	+0.63980	-359	-230
18 58.6	+ 49.52	+ 75 21.4	+39 54 16.2	+0.63809	0.76819	+0.83064	-328	-272
10 04.8	- 99.36	-151 12.3	-33 51 41.1	-0.55402	0.83126	-0.66648	-355	+236
10 04.6	- 99.33	-151 09.5	-33 49 45.7	-0.55356	0.83157	-0.66568	-355	+236

If the horizontal parallax, $\pi = 8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{xy} \cos \theta$, $\Delta Y = \Delta_{xy} \sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Syracuse, New York	Syracuse University Observatory	160	+	5 04	33.36
Tacubaya, Mexico	National Observatory	2297	+	6 36	46.74
Tanakami, Japan	Yamamoto Observatory	165	-	9 03	57.4
Tartu, Estonian S. S. R.	Astronomical Obs. of Acad. of Sciences	67	-	1 46	53.18 c
Tashkent, Uzbek S. S. R.	Tashkent Observatory	477	-	4 37	10.47 c
Teramo, Italy	Collurania Observatory	398	-	0 54	56
Tokyo, Japan	Tokyo Astronomical Obs., at Mitaka	59	-	9 18	10.10 c
Tomsk, R. S. F. S. R.	University Observatory	130	-	5 39	47.16
Tonantzintla, Mexico	Observatorio Astrofisico Nacional	2150	+	6 33	15.32
Toronto, Canada	Meteorological Observatory	116	+	5 17	35.60 c
Toruń, Poland	Copernicus University Obs., at Piwnice	90	-	1 14	13.4
Toulouse, France	University Observatory	195	-	0 05	51.01 c
Trieste, Italy	Astronomical Observatory	67	-	0 55	04.9
Troy, New York	Obs. of Rensselaer Polytechnic Inst.	82	+	4 54	43
Tsingtao, China	Observatory of Tsingtao	78	-	8 01	16.71 c
Tucson, Arizona	Steward Obs., University of Arizona	757	+	7 23	47.68 b
Turin, Italy	Pino Torinese Observatory	618	-	0 31	05.95 c
Turku, Finland	University Observatory	28	-	1 28	55.03 b
Uccle, Belgium	Royal Observatory	105	-	0 17	25.97 c
Ukiah, California	International Latitude Observatory	200	+	8 12	50.3 d
University, Alabama	Observatory, University of Alabama	87	+	5 50	10.2
Uppsala, Sweden	University Astronomical Observatory	21	-	1 10	30.17 a
Urbana, Illinois	Observatory, University of Illinois	236	+	5 52	53.90 a
Utrecht, Netherlands	Sonnenborgh Observatory	14	-	0 20	31.01 a
Venice, Italy	Observatory of the Nautical Institute	15	-	0 49	22.12 c
Victoria, British Columbia	Dominion Astrophysical Observatory	229	+	8 13	40.17 b
Vienna, Austria	Kuffner Observatory	293	-	1 05	10.96
Vienna, Austria	University Observatory, since 1879	240	-	1 05	21.35 c
Vilnius, Lithuanian S. S. R. . . .	University Observatory	122	-	1 41	08.76 a
Wallington, Surrey	Observatory of W. Green	—	+	0 00	30.40 a
Warsaw, Poland	Observatory of the Technical University	144	-	1 24	02.4
Warsaw, Poland	University Observatory	121	-	1 24	07.26
Washington, D. C.	United States Naval Observatory	86*	+	5 08	15.78 a
Washington, D. C.	Georgetown College Observatory	62	+	5 08	18.3 a
Washington, D. C.	Smithsonian Astrophysical Observatory	10	+	5 08	06.24
Weesp, Netherlands	Observatory of J. van Diggelen	—	-	0 20	10.14
Wellesley, Massachusetts	Whitin Observatory, Wellesley College	61	+	4 45	13.3
Wellington, New Zealand	Carter Observatory	129	-	11 39	03.69 a
Wellington, New Zealand	Observatory of R. C. Hayes	180	-	11 38	58.8
Williams Bay, Wisconsin	Yerkes Obs., University of Chicago	334	+	5 54	13.24 a
Williamstown, Massachusetts . . .	Field Memorial Obs., Williams College	213	+	4 52	50
Woodstock, Maryland	Woodstock College Observatory	121	+	5 07	30.0
Wroclaw, Poland	University Observatory	117	-	1 08	21.22
Wurzburg, Germany	University Observatory	200	-	0 39	44.71

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

* Bench mark in clock house; $\lambda = +5^{\text{h}} 08^{\text{m}} 15^{\text{s}}.78$, $\phi = +38^{\circ} 55' 14''.0$.

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{xy}	ΔZ
h m	s	° ' "	° ' "					
18 55.4	+ 50.03	+ 76 08.3	+43 02 13.1	+0.67896	0.73208	+0.92744	-312	-290
17 23.2	+ 65.18	+ 99 11.7	+19 24 17.9	+0.33025	0.94388	+0.34989	-403	-141
9 04.0	- 89.36	-135 59.3	+34 58 18	+0.56996	0.82036	+0.69477	-350	-243
1 46.9	- 17.56	- 26 43.3	+58 22 47.2	+0.84790	0.52557	+1.61327	-224	-362
4 37.2	- 45.53	- 69 17.6	+41 19 30.4	+0.65690	0.75213	+0.87339	-321	-280
0 54.9	- 9.02	- 13 44.0	+42 39 27	+0.67414	0.73660	+0.91521	-314	-288
9 18.2	- 91.69	-139 32.5	+35 40 21.4	+0.57990	0.81330	+0.71302	-347	-247
5 39.8	- 55.82	- 84 56.8	+56 28 06.3	+0.82993	0.55370	+1.49888	-236	-354
17 26.7	+ 64.60	+ 98 18.8	+19 01 57.9	+0.32414	0.94599	+0.34265	-404	-138
18 42.4	+ 52.17	+ 79 23.9	+43 40 00.8	+0.68694	0.72454	+0.94810	-309	-293
1 14.2	- 12.19	- 18 33.3	+53 05 44	+0.79599	0.60179	+1.32271	-257	-340
0 05.9	- 0.96	- 1 27.8	+43 36 44.1	+0.68626	0.72521	+0.94629	-309	-293
0 55.1	- 9.05	- 13 46.2	+45 38 35.5	+0.71142	0.70034	+1.01583	-299	-304
19 05.3	+ 48.42	+ 73 40.8	+42 43 45	+0.67503	0.73572	+0.91751	-314	-288
8 01.3	- 79.06	-120 19.2	+36 04 11.3	+0.58550	0.80925	+0.72351	-345	-250
16 36.2	+ 72.90	+110 56.9	+32 13 59.4	+0.53035	0.84680	+0.62630	-361	-226
0 31.1	- 5.11	- 7 46.5	+45 02 16.3	+0.70407	0.70790	+0.99459	-302	-300
1 28.9	- 14.61	- 22 13.8	+60 27 08.7	+0.86631	0.49441	+1.75221	-211	-370
0 17.4	- 2.86	- 4 21.5	+50 47 54.7	+0.77129	0.63334	+1.21781	-270	-329
15 47.2	+ 80.96	+123 12.6	+39 08 12.0	+0.62779	0.77671	+0.80827	-331	-268
18 09.8	+ 57.52	+ 87 32.6	+33 12 33	+0.54457	0.83753	+0.65021	-357	-232
1 10.5	- 11.58	- 17 37.5	+59 51 29.4	+0.86114	0.50341	+1.71061	-215	-367
18 07.1	+ 57.97	+ 88 13.5	+40 06 20.2	+0.64079	0.76596	+0.83658	-327	-273
0 20.5	- 3.37	- 5 07.8	+52 05 09.6	+0.78528	0.61577	+1.27528	-263	-335
0 49.4	- 8.11	- 12 20.5	+45 26 10.5	+0.70889	0.70290	+1.00852	-300	-302
15 46.3	+ 81.10	+123 25.0	+48 31 15.7	+0.74560	0.66362	+1.12353	-283	-318
1 05.2	- 10.71	- 16 17.7	+48 12 46.7	+0.74204	0.66764	+1.11143	-285	-317
1 05.4	- 10.74	- 16 20.3	+48 13 55.1	+0.74225	0.66739	+1.11217	-285	-317
1 41.1	- 16.62	- 25 17.2	+54 40 59.1	+0.81232	0.57941	+1.40198	-247	-347
23 59.5	+ 0.08	+ 0 07.6	+51 21 37.0	+0.77743	0.62570	+1.24249	-267	-332
1 24.0	- 13.80	- 21 00.6	+52 13 21	+0.78675	0.61390	+1.28157	-262	-336
1 24.1	- 13.82	- 21 01.8	+52 13 04.6	+0.78670	0.61396	+1.28135	-262	-336
18 51.7	+ 50.64	+ 77 03.9	+38 55 14.0	+0.62486	0.77906	+0.80206	-332	-267
18 51.7	+ 50.65	+ 77 04.6	+38 54 26.0	+0.62467	0.77921	+0.80168	-332	-267
18 51.9	+ 50.61	+ 77 01.6	+38 53 17.3	+0.62441	0.77941	+0.80113	-333	-266
0 20.2	- 3.31	- 5 02.5	+52 18 37.0	+0.78768	0.61268	+1.28563	-261	-336
19 14.8	+ 46.85	+ 71 18.3	+42 17 37.1	+0.66943	0.74084	+0.90361	-316	-286
11 39.1	-114.84	-174 45.9	-41 17 03.9	-0.65634	0.75256	-0.87214	-321	+280
11 39.0	-114.82	-174 44.7	-41 17 00.2	-0.65633	0.75258	-0.87211	-321	+280
18 05.8	+ 58.19	+ 88 33.3	+42 34 12.6	+0.67302	0.73762	+0.91241	-315	-287
19 07.2	+ 48.10	+ 73 12.5	+42 42 30	+0.67477	0.73598	+0.91684	-314	-288
18 52.5	+ 50.51	+ 76 52.5	+39 20 05	+0.63045	0.77452	+0.81399	-330	-269
1 08.4	- 11.23	- 17 05.3	+51 06 42.1	+0.77473	0.62910	+1.23150	-268	-331
0 39.7	- 6.53	- 9 56.2	+49 47 27.6	+0.76008	0.64687	+1.17501	-276	-324

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h=\theta-\alpha$ and θ =sidereal time at 0^h+sidereal equivalent of U.T.- λ

Otherwise add $\Delta X=\Delta_{xy} \cos \theta$, $\Delta Y=\Delta_{xy} \sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Zagreb, Yugoslavia	Observatory of Faculty of Technology	146	− 1 04 05.11
Zô-sè, China	Astronomical Observatory	100	− 8 04 44.75 a
Zürich, Switzerland	Obs. of Swiss Polytechnic School	469	− 0 34 12.26 c

RADIO OBSERVATORIES

Place	Description	Altitude	Longitude
		m	h m s
Achimota, Ghana	University College of the Gold Coast	18	+ 0 00 54.67
Big Pine, California	California Institute of Technology	1216	+ 7 53 10.56
Boulder, Colorado	National Bureau of Standards Field Station	1595	+ 7 00 29.47
Cambridge, England	Mullard Radio Astro. Obs., Univ. of Cambridge	26	− 0 00 09.6
Columbus, Ohio	Radio Observatory, Ohio State University	245	+ 5 32 10.24
Delaware, Ohio	Ohio State-Ohio Wesleyan Radio Observatory	282	+ 5 32 11.56
Dwingeloo, Netherlands	Foundation for Radio Astronomy	25	− 0 25 35.25
Eschweiler, Germany	Stockert Radio Obs. of Bonn University	435	− 0 26 53.48
Freiburg, Germany	Fraunhofer Institute	1240	− 0 31 37.4
Fort Davis, Texas	Radio Astronomy Station of Harvard Col. Obs.	1580	+ 6 55 48
Gainesville, Florida	Observatory of the University of Florida	38	+ 5 29 22.47
Gothenburg, Sweden	Onsala Obs., Chalmers Univ. of Technology	14	− 0 47 40
Grafton, New York	Sampson Sta., Rensselaer Polytechnic Inst.	493	+ 4 53 48
Harvard, Massachusetts	George R. Agassiz Station of Harvard Obs.	183	+ 4 46 14.2
Helsinki, Finland	Radio Astronomy Station, Univ. of Helsinki	2	− 1 40 02
Ithaca, New York	Radio Astronomy Laboratory, Cornell Univ.	341	+ 5 05 48.46
Jodrell Bank, Cheshire	Jodrell Bank Exper. Sta., Univ. of Manchester	70	+ 0 09 13.47
Kiel, Germany	Radio Observatory, University of Kiel	38	− 0 40 29.0
Nançay, France	Radio Obs. of Nançay, Observatory of Paris	150	− 0 08 47.3
Portage Lake, Michigan	Radio Astronomy Obs., Univ. of Michigan	345	+ 5 35 44.5
Potsdam, Germany	Astrophysical Obs., German Acad. of Sciences	35	− 0 52 32.8
South Gloucester, Ontario	Goth Hill Obs., Nat. Research Coun. of Canada	122	+ 5 02 20.67
Stanford, California	Radio Propagation Lab., Stanford University	80	+ 8 08 45.2
Sydney, New South Wales	Dapto Field Station, Government Observatory	8	−10 03 02.0
Sydney, New South Wales	“Fleurs” Field Station, Government Obs.	50	−10 03 05.6
Tokyo, Japan	Tokyo Astronomical Observatory at Mitaka	70	− 9 18 09.6
Washington, D. C.	Radio Astronomy Obs., Naval Research Lab.	30	+ 5 08 06.45

a Equatorial refractor b Equatorial reflector c Transit or meridian circle d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx_y	ΔZ
h m	s	° '	° ' "					
1 04.1	- 10.53	- 16 01.3	+45 49 32.3	+0.71365	0.69807	+1.02232	-298	-304
8 04.7	- 79.63	-121 11.2	+31 05 47.6	+0.51348	0.85708	+0.59910	-366	-219
0 34.2	- 5.62	- 8 33.1	+47 22 38.3	+0.73227	0.67845	+1.07932	-289	-312

RADIO OBSERVATORIES

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx_y	ΔZ
h m	s	° '	° ' "					
23 59.1	+ 0.15	+ 0 13.7	+ 5 38	+0.09750	0.99521	+0.09797	-425	- 42
16 06.8	+77.73	+118 17.6	+37 13 53.8	+0.60183	0.79733	+0.75480	-340	-257
16 59.5	+69.08	+105 07.4	+40 05 28	+0.64073	0.76628	+0.83616	-327	-273
0 00.2	- 0.03	- 0 02.4	+52 09 45	+0.78610	0.61472	+1.27880	-262	-335
18 27.8	+54.57	+ 83 02.6	+40 01 00.2	+0.63960	0.76695	+0.83395	-327	-273
18 27.8	+54.57	+ 83 02.9	+40 15 04.7	+0.64273	0.76432	+0.84091	-326	-274
0 25.6	- 4.20	- 6 23.8	+52 48 46.7	+0.79301	0.60571	+1.30921	-258	-338
0 26.9	- 4.42	- 6 43.4	+50 34 14	+0.76881	0.63645	+1.20797	-272	-328
0 31.6	- 5.20	- 7 54.4	+47 54 50	+0.73866	0.67162	+1.09982	-286	-315
17 04.2	+68.30	+103 57.0	+30 38	+0.50668	0.86141	+0.58820	-367	-216
18 30.6	+54.11	+ 82 20.6	+29 38 36	+0.49168	0.86984	+0.56525	-371	-210
0 47.7	- 7.83	- 11 55.0	+57 23.5	+0.83872	0.54018	+1.55265	-230	-358
19 06.2	+48.26	+ 73 27	+42 47 35	+0.67589	0.73501	+0.91956	-314	-288
19 13.8	+47.02	+ 71 33.5	+42 30 13	+0.67215	0.73839	+0.91029	-315	-287
1 40.0	-16.43	- 25 00.5	+60 13.4	+0.86432	0.49788	+1.73600	-212	-369
18 54.2	+50.24	+ 76 27.1	+42 29 18	+0.67197	0.73859	+0.90980	-315	-287
23 50.8	+ 1.52	+ 2 18.4	+53 14 11	+0.79746	0.59982	+1.32950	-256	-340
0 40.5	- 6.65	- 10 07.2	+54 20 32	+0.80885	0.58424	+1.38444	-249	-345
0 08.8	- 1.44	- 2 11.8	+47 22 48	+0.73227	0.67838	+1.07942	-289	-312
18 24.3	+55.15	+ 83 56.1	+42 23 52.5	+0.67081	0.73965	+0.90692	-316	-286
0 52.5	- 8.63	- 13 08.2	+52 17 06.3	+0.78741	0.61303	+1.28446	-262	-336
18 57.7	+49.67	+ 75 35.2	+45 17 45.7	+0.70719	0.70466	+1.00359	-301	-302
15 51.2	+80.29	+122 11.3	+37 23.9	+0.60403	0.79543	+0.75937	-339	-258
10 03.0	-99.06	-150 45.5	-34 28.3	-0.56280	0.82530	-0.68194	-352	+240
10 03.1	-99.07	-150 46.4	-33 51.5	-0.55398	0.83129	-0.66641	-355	+236
9 18.2	-91.69	-139 32.4	+35 40 18.2	+0.57989	0.81331	+0.71300	-347	-247
18 51.9	+50.61	+ 77 01.6	+38 49 16.6	+0.62351	0.78014	+0.79922	-333	-266

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{1}{\sin \delta} \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h=\theta-\alpha$ and θ =sidereal time at 0^h+sidereal equivalent of U.T.- λ

Otherwise add $\Delta X=\Delta x_y \cos \theta$, $\Delta Y=\Delta x_y \sin \theta$, ΔZ to solar co-ordinates to eliminate parallax.

INDEX LIST

Actual names of observatories are in bold type.
Names of owners of private observatories are in italics.
Radio observatories designated by R.

Name, Etc.	Place	Name, Etc.	Place
Åbo	Turku	Dearborn	Evanston
Agassiz Station	Harvard	De Pauw University	Greencastle
Alabama, Univ. of	University	<i>Diggelen, van</i>	Weesp
Allegheny	Pittsburgh	Dominion	Ottawa
Archenhold	Berlin-Treptow	Dominion Astrophysical	Victoria
Arizona, Univ. of	Tucson	Drake University	Des Moines
Baden	Heidelberg	Dudley	Albany
Batavia	Jakarta	Dunsink	Dublin
<i>Bateson</i>	Rarotonga	Dyer	Nashville
<i>Beardsley</i>	Springfield	Eidgenössischen Sternwarte	Zürich
Bergedorf	Hamburg	Engelhardt	Kazan
Bloomington (Branch)	Brooklyn	Fabra	Barcelona
Bonn University (Branch)	Hoher List	Field	Williamstown
Bonn University R.	Eschweiler	Flammarion	Juvisy
Bosscha	Lembang	"Fleurs" Field Station R.	Sydney
Bouzaréah	Algiers	Floirac	Bordeaux
Bowdoin College	Brunswick	Florence	Arcetri
Boyden Station	Bloemfontein	Florida, Univ. of R.	Gainesville
Brackett	Claremont	Flower and Cook	Philadelphia
Bradley	Decatur	Franklin Institute	Philadelphia
Brera	Milan	Fraunhofer R.	Freiburg
Breslau	Wroclaw	Fuertes	Ithaca
Brown University	Providence	<i>Gayfer</i>	Cleethorpes
<i>Bruijn</i>	Leiden	Georgetown College	Washington
Brussels	Uccle	Goethe Link	Brooklyn
Cajal	Caracas	Goodsell	Northfield
California Inst. of Tech.	Mount Palomar	Goth Hill R.	South Gloucester
California Inst. of Tech. R.	Big Pine	<i>Green</i>	Wallington
California, Univ. of	Berkeley	Haig	Dehra Dun
California, Univ. of	Mount Hamilton	Harvard College	Cambridge
Cambridge (Branch)	Bloemfontein	Harvard College (Branch)	Harvard
Capodimonte	Naples	Harvard College (Branch) R.	Fort Davis
Carleton College	Northfield	<i>Hayes</i>	Wellington
Carnegie Institution	Mount Wilson	<i>Hegvad</i>	Copenhagen
Carter	Wellington	Hendaye	Abbadia
<i>Caunter</i>	Billingshurst	Illinois, Univ. of	Urbana
Chabot	Oakland	India, Survey of	Dehra Dun
Chamberlin	Denver	Indiana, Univ. of	Bloomington
Charles University	Prague	Indiana, Univ. of	Brooklyn
Chicago, Univ. of	Williams Bay	International Latitude	Carloforte
Columbia University	New York	International Latitude	Gaithersburg
Commonwealth	Canberra	International Latitude	Jakarta
Copernicus University	Torun	International Latitude	Kitab
Cordoba (Branch)	Bosque Alegre	International Latitude	Mizusawa
Cornell University	Ithaca	International Latitude	Ukiah
<i>Couling</i>	Dunedin	Iowa, Univ. of	Iowa City
Dapto Field Station R.	Sydney	<i>Jaakola</i>	Huittinen
<i>Darnell</i>	Copenhagen		
Dartmouth College	Hanover		
David Dunlap	Richmond Hill		

INDEX LIST

Actual names of observatories are in bold type.
 Names of owners of private observatories are in italics.
 Radio observatories designated by R.

Name, Etc.	Place
Kapteyn Laboratory . . .	Groningen
<i>Kenskamp</i>	Hardenberg
<i>Kierulff</i>	Copenhagen
Kirkwood	Bloomington
Königstuhl	Heidelberg
Konkoly	Budapest
Kuffner	Vienna
Kwasan	Kyoto
Ladd	Providence
<i>Lange, de</i>	Blaricum
Lawrence College	Appleton
Leander McCormick . . .	Charlottesville
Lehigh University	South Bethlehem
Leuschner	Berkeley
Lick	Mount Hamilton
Link	Brooklyn
London, Univ. of	Mill Hill
Longchamp	Marseilles
Louisiana, Univ. of . . .	Baton Rouge
Lowell	Flagstaff
McDonald	Fort Davis
McGill University	Montreal
McKim	Greencastle
McMath-Hulbert	Lake Angelus
McMillin	Columbus
Maine, Univ. of	Orono
<i>Mak</i>	Driehuis-Velsen
<i>Malsch</i>	Karlsruhe
Manchester, Univ. of R. . .	Jodrell Bank
Manila	Baguio City
Masaryk University	Brno
Mazelspoort	Bloemfontein
Melton	Columbia
<i>Meulen, van der</i>	Hoorn
Michigan, Univ. of	Ann Arbor
Michigan, Univ. of (Branch).	Lake Angelus
Michigan, Univ. of (Branch).	Portage Lake
<i>Miličević</i>	Blaca
<i>Millard</i>	Portland
Minnesota, Univ. of	Minneapolis
Mississippi, Univ. of	Oxford
Mitaka	Tokyo
Mitchell	Nantucket
Monte Mario	Rome
Mont Gros	Nice
Morrison	Fayette
Mount Holyoke College . . .	South Hadley
Mount Locke	Fort Davis
Mount Stromlo	Canberra
<i>Muijtjens</i>	Nuth
Mullard R	Cambridge

Name, Etc.	Place
Nat. Bu. of Standards R. . .	Boulder
Naval Research Lab. R. . .	Washington
Netherland's Foundation R..	Dwingeloo
New Brunswick, Univ. of . .	Fredericton
Nizamiah	Hyderabad
Norman Lockyer	Sidmouth
Northwestern Univ.	Evanston
<i>Novak</i>	Prague
<i>Ogilvie</i>	Carnoustie
Ohio State Univ.	Columbus
Ohio Wesleyan Univ.	Delaware
Oklahoma, Univ. of	Norman
Ole Römer	Aarhus
Otago Institute	Dunedin
Padua, Univ. of	Asiago
Paris, Univ. of R.	Nançay
Pennsylvania, Univ. of . . .	Philadelphia
Perkins	Delaware
Pino Torinese	Turin
Piwnice	Toruń
Pomona College	Claremont
<i>Power</i>	Palo Alto
Pulkovo (Branch)	Simeis
Purple Mountain	Nanking
<i>Raalten, van</i>	Harderwijk
Radcliffe	Pretoria
<i>Rasmussen</i>	Helsingör
Remeis	Bamberg
Rensselaer Poly. Inst . . .	Troy
Rensselaer Poly. Inst. R. . .	Grafton
Riverview College	Sydney
Royal Greenwich	Herstmonceux
Royal Greenwich (Branch) .	Abinger
Sacramento Peak	Sunspot
Sampson Station R.	Grafton
San Bernardo	Santiago
Saltsjöbaden	Stockholm
Sayre	South Bethlehem
<i>Schmidt, D.</i>	Bussum
<i>Schmidt, M.</i>	Groningen
Scott College	Decatur
Shattuck	Hanover
<i>Sill</i>	Mamaroneck
Smith	Beloit
Smith	Geneva
Smith College	Northampton
Smithsonian	Washington
Smithsonian (Branch) . . .	Mount Wilson
Sonnenborgh	Utrecht

INDEX LIST

Actual names of observatories are in bold type.
 Names of owners of private observatories are in italics.
 Radio observatories designated by R.

Name, Etc.	Place	Name, Etc.	Place
South Carolina, Univ. of . . .	Columbia	Vanderbilt University . . .	Nashville
Sproul	Swarthmore	Vassar College	Poughkeepsie
<i>Steavenson</i>	Cambridge	<i>Vastenholt</i>	Beverwijk
Stefánik	Prague	Vatican	Castel Gandolfo
Sternberg Institute	Moscow	<i>Venter</i>	Pretoria
Steward	Tucson	Vicenza	Asiago
<i>Stevens</i>	Larchmont	Ville-Marie	Montreal
Stockert R.	Eschweiler	Virginia, Univ. of	Charlottesville
Strawbridge	Haverford	Vleck, Van	Middletown
Tadjik	Stalinabad	<i>Walker</i>	Haarlem
Tapada	Lisbon	Warner and Swasey	Cleveland
Texas, Univ. of	Fort Davis	Washburn	Madison
Tilanus	Amsterdam	Washington University . . .	St. Louis
Tohoku University	Sendai	Wesleyan University	Middletown
Toronto, Univ. of	Richmond Hill	Whitin	Wellesley
Toulouse	Pic du Midi	<i>Wieth-Knudsen</i>	Copenhagen
Turret	Springfield	Williams College	Williamstown
Underwood	Appleton	Williston	South Hadley
Union	Johannesburg	Wisconsin, Univ. of	Madison
Union (Annexe)	Hartebeespoort	Yale University	New Haven
Urania	Copenhagen	Yale (Branch)	Johannesburg
Ursa	Helsinki	Yamamoto	Tanakami
U. S. Naval	Washington	Yerkes	Williams Bay
U. S. Naval (Branch)	Flagstaff		
U. S. Naval (Branch)	Richmond		

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON OF JANUARY 0

Julian Calendar

Subtract	CENTURY YEARS			
102 2700	1600	1500	1400	1300
87 6600	1200	1100	1000	900
73 0500	800	700	600	500
58 4400	400	300	200	100
43 8300	0	...	...	...
43 8300	...	0	100	200
29 2200	300	400	500	600
14 6100	700	800	900	1000
0	1100	1200	1300	1400

This table gives the Julian Day numbers for January 0 of every leap year from A. D. 1100 to A. D. 1896, and the reductions to be applied to them to obtain the numbers for January 0 of the leap years in other centuries from 1697 B. C. to A. D. 2296, except in the 20th century which is tabulated on the following two pages.

Gregorian Calendar

							CENTURY YEARS				
		300	400	500	600						
		700	800	900	1000						
		1100	1200	1300	1400	1500	1600	1700	1800		
LEAP YEARS									Add 14 6097 for		
							2000	2100	2200		
B. C.	A. D.	Julian									
—	0	212 2832	215 9357	219 5882	223 2407	226 8932	230 5447	*234 1971	*237 8495		
97	4	212 4293	216 0818	219 7343	223 3868	227 0393	230 6908	234 3432	237 9956		
93	8	212 5754	216 2279	219 8804	223 5329	227 1854	230 8369	234 4893	238 1417		
89	12	212 7215	216 3740	220 0265	223 6790	227 3315	230 9830	234 6354	238 2878		
85	16	212 8676	216 5201	220 1726	223 8251	227 4776	231 1291	234 7815	238 4339		
81	20	213 0137	216 6662	220 3187	223 9712	227 6237	231 2752	234 9276	238 5800		
77	24	213 1598	216 8123	220 4648	224 1173	227 7698	231 4213	235 0737	238 7261		
73	28	213 3059	216 9584	220 6109	224 2634	227 9159	231 5674	235 2198	238 8722		
69	32	213 4520	217 1045	220 7570	224 4095	228 0620	231 7135	235 3659	239 0183		
65	36	213 5981	217 2506	220 9031	224 5556	228 2081	231 8596	235 5120	239 1644		
61	40	213 7442	217 3967	221 0492	224 7017	228 3542	232 0057	235 6581	239 3105		
57	44	213 8903	217 5428	221 1953	224 8478	228 5003	232 1518	235 8042	239 4566		
53	48	214 0364	217 6889	221 3414	224 9939	228 6464	232 2979	235 9503	239 6027		
49	52	214 1825	217 8350	221 4875	225 1400	228 7925	232 4440	236 0964	239 7488		
45	56	214 3286	217 9811	221 6336	225 2861	228 9386	232 5901	236 2425	239 8949		
41	60	214 4747	218 1272	221 7797	225 4322	229 0847	232 7362	236 3886	240 0410		
37	64	214 6208	218 2733	221 9258	225 5783	229 2308	232 8823	236 5347	240 1871		
33	68	214 7669	218 4194	222 0719	225 7244	229 3769	233 0284	236 6808	240 3332		
29	72	214 9130	218 5655	222 2180	225 8705	229 5230	233 1745	236 8269	240 4793		
25	76	215 0591	218 7116	222 3641	226 0166	229 6691	233 3206	236 9730	240 6254		
21	80	215 2052	218 8577	222 5102	226 1627	229 8152	233 4667	237 1191	240 7715		
17	84	215 3513	219 0038	222 6563	226 3088	Gregorian 229 9603	233 6128	237 2652	240 9176		
13	88	215 4974	219 1499	222 8024	226 4549	230 1064	233 7589	237 4113	241 0637		
9	92	215 6435	219 2960	222 9485	226 6010	230 2525	233 9050	237 5574	241 2098		
5	96	215 7896	219 4421	223 0946	226 7471	230 3986	234 0511	237 7035	241 3559		
1	—	215 9357	219 5882	223 2407	226 8932	* For Jan. —1: these century years are not leap years.					

*For Jan. —1; these century years are not leap years.

In the following table, for dates from 1582 October 15 to 1583 December 31 inclusive, Gregorian calendar, *diminish all numbers by 10*.

In century years of the Gregorian calendar that are not leap years, for *January 0* use the number 1 instead of the tabular value 0, and for *February 0* use 32 instead of 31.

YEARS AFTER LEAP YEAR**	MONTHS											
	Add to January 0 of leap year											
	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
0	0	31	60	91	121	152	182	213	244	274	305	335
1	366	397	425	456	486	517	547	578	609	639	670	700
2	731	762	790	821	851	882	912	943	974	1004	1035	1065
3	1096	1127	1155	1186	1216	1247	1277	1308	1339	1369	1400	1430

**Reckoned from successive leap years, always in the direction of increasing J. D. Number.

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON, A. D. 1900-1950

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
1900	241 5020	5051	5079	5110	5140	5171	5201	5232	5263	5293	5324	5354
1901	5385	5416	5444	5475	5505	5536	5566	5597	5628	5658	5689	5719
1902	5750	5781	5809	5840	5870	5901	5931	5962	5993	6023	6054	6084
1903	6115	6146	6174	6205	6235	6266	6296	6327	6358	6388	6419	6449
1904	6480	6511	6540	6571	6601	6632	6662	6693	6724	6754	6785	6815
1905	241 6846	6877	6905	6936	6966	6997	7027	7058	7089	7119	7150	7180
1906	7211	7242	7270	7301	7331	7362	7392	7423	7454	7484	7515	7545
1907	7576	7607	7635	7666	7696	7727	7757	7788	7819	7849	7880	7910
1908	7941	7972	8001	8032	8062	8093	8123	8154	8185	8215	8246	8276
1909	8307	8338	8366	8397	8427	8458	8488	8519	8550	8580	8611	8641
1910	241 8672	8703	8731	8762	8792	8823	8853	8884	8915	8945	8976	9006
1911	9037	9068	9096	9127	9157	9188	9218	9249	9280	9310	9341	9371
1912	9402	9433	9462	9493	9523	9554	9584	9615	9646	9676	9707	9737
1913	9768	9799	9827	9858	9888	9919	9949	9980	*0011	*0041	*0072	*0102
1914	242 0133	0164	0192	0223	0253	0284	0314	0345	0376	0406	0437	0467
1915	242 0498	0529	0557	0588	0618	0649	0679	0710	0741	0771	0802	0832
1916	0863	0894	0923	0954	0984	1015	1045	1076	1107	1137	1168	1198
1917	1229	1260	1288	1319	1349	1380	1410	1441	1472	1502	1533	1563
1918	1594	1625	1653	1684	1714	1745	1775	1806	1837	1867	1898	1928
1919	1959	1990	2018	2049	2079	2110	2140	2171	2202	2232	2263	2293
1920	242 2324	2355	2384	2415	2445	2476	2506	2537	2568	2598	2629	2659
1921	2690	2721	2749	2780	2810	2841	2871	2902	2933	2963	2994	3024
1922	3055	3086	3114	3145	3175	3206	3236	3267	3298	3328	3359	3389
1923	3420	3451	3479	3510	3540	3571	3601	3632	3663	3693	3724	3754
1924	3785	3816	3845	3876	3906	3937	3967	3998	4029	4059	4090	4120
1925	242 4151	4182	4210	4241	4271	4302	4332	4363	4394	4424	4455	4485
1926	4516	4547	4575	4606	4636	4667	4697	4728	4759	4789	4820	4850
1927	4881	4912	4940	4971	5001	5032	5062	5093	5124	5154	5185	5215
1928	5246	5277	5306	5337	5367	5398	5428	5459	5490	5520	5551	5581
1929	5612	5643	5671	5702	5732	5763	5793	5824	5855	5885	5916	5946
1930	242 5977	6008	6036	6067	6097	6128	6158	6189	6220	6250	6281	6311
1931	6342	6373	6401	6432	6462	6493	6523	6554	6585	6615	6646	6676
1932	6707	6738	6767	6798	6828	6859	6889	6920	6951	6981	7012	7042
1933	7073	7104	7132	7163	7193	7224	7254	7285	7316	7346	7377	7407
1934	7438	7469	7497	7528	7558	7589	7619	7650	7681	7711	7742	7772
1935	242 7803	7834	7862	7893	7923	7954	7984	8015	8046	8076	8107	8137
1936	8168	8199	8228	8259	8289	8320	8350	8381	8412	8442	8473	8503
1937	8534	8565	8593	8624	8654	8685	8715	8746	8777	8807	8838	8868
1938	8899	8930	8958	8989	9019	9050	9080	9111	9142	9172	9203	9233
1939	9264	9295	9323	9354	9384	9415	9445	9476	9507	9537	9568	9598
1940	242 9629	9660	9689	9720	9750	9781	9811	9842	9873	9903	9934	9964
1941	9995	*0026	*0054	*0085	*0115	*0146	*0176	*0207	*0238	*0268	*0299	*0329
1942	243 0360	0391	0419	0450	0480	0511	0541	0572	0603	0633	0664	0694
1943	0725	0756	0784	0815	0845	0876	0906	0937	0968	0998	1029	1059
1944	1090	1121	1150	1181	1211	1242	1272	1303	1334	1364	1395	1425
1945	243 1456	1487	1515	1546	1576	1607	1637	1668	1699	1729	1760	1790
1946	1821	1852	1880	1911	1941	1972	2002	2033	2064	2094	2125	2155
1947	2186	2217	2245	2276	2306	2337	2367	2398	2429	2459	2490	2520
1948	2551	2582	2611	2642	2672	2703	2733	2764	2795	2825	2856	2886
1949	2917	2948	2976	3007	3037	3068	3098	3129	3160	3190	3221	3251
1950	243 3282	3313	3341	3372	3402	3433	3463	3494	3525	3555	3586	3616

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON, A. D. 1950-2000

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
1950	243 3282	3313	3341	3372	3402	3433	3463	3494	3525	3555	3586	3616
1951	3647	3678	3706	3737	3767	3798	3828	3859	3890	3920	3951	3981
1952	4012	4043	4072	4103	4133	4164	4194	4225	4256	4286	4317	4347
1953	4378	4409	4437	4468	4498	4529	4559	4590	4621	4651	4682	4712
1954	4743	4774	4802	4833	4863	4894	4924	4955	4986	5016	5047	5077
1955	243 5108	5139	5167	5198	5228	5259	5289	5320	5351	5381	5412	5442
1956	5473	5504	5533	5564	5594	5625	5655	5686	5717	5747	5778	5808
1957	5839	5870	5898	5929	5959	5990	6020	6051	6082	6112	6143	6173
1958	6204	6235	6263	6294	6324	6355	6385	6416	6447	6477	6508	6538
1959	6569	6600	6628	6659	6689	6720	6750	6781	6812	6842	6873	6903
1960	243 6934	6965	6994	7025	7055	7086	7116	7147	7178	7208	7239	7269
1961	7300	7331	7359	7390	7420	7451	7481	7512	7543	7573	7604	7634
1962	7665	7696	7724	7755	7785	7816	7846	7877	7908	7938	7969	7999
1963	8030	8061	8089	8120	8150	8181	8211	8242	8273	8303	8334	8364
1964	8395	8426	8455	8486	8516	8547	8577	8608	8639	8669	8700	8730
1965	243 8761	8792	8820	8851	8881	8912	8942	8973	9004	9034	9065	9095
1966	9126	9157	9185	9216	9246	9277	9307	9338	9369	9399	9430	9460
1967	9491	9522	9550	9581	9611	9642	9672	9703	9734	9764	9795	9825
1968	9856	9887	9916	9947	9977	*0008	*0038	*0069	*0100	*0130	*0161	*0191
1969	244 0222	0253	0281	0312	0342	0373	0403	0434	0465	0495	0526	0556
1970	244 0587	0618	0646	0677	0707	0738	0768	0799	0830	0860	0891	0921
1971	0952	0983	1011	1042	1072	1103	1133	1164	1195	1225	1256	1286
1972	1317	1348	1377	1408	1438	1469	1499	1530	1561	1591	1622	1652
1973	1683	1714	1742	1773	1803	1834	1864	1895	1926	1956	1987	2017
1974	2048	2079	2107	2138	2168	2199	2229	2260	2291	2321	2352	2382
1975	244 2413	2444	2472	2503	2533	2564	2594	2625	2656	2686	2717	2747
1976	2778	2809	2838	2869	2899	2930	2960	2991	3022	3052	3083	3113
1977	3144	3175	3203	3234	3264	3295	3325	3356	3387	3417	3448	3478
1978	3509	3540	3568	3599	3629	3660	3690	3721	3752	3782	3813	3843
1979	3874	3905	3933	3964	3994	4025	4055	4086	4117	4147	4178	4208
1980	244 4239	4270	4299	4330	4360	4391	4421	4452	4483	4513	4544	4574
1981	4605	4636	4664	4695	4725	4756	4786	4817	4848	4878	4909	4939
1982	4970	5001	5029	5060	5090	5121	5151	5182	5213	5243	5274	5304
1983	5335	5366	5394	5425	5455	5486	5516	5547	5578	5608	5639	5669
1984	5700	5731	5760	5791	5821	5852	5882	5913	5944	5974	6005	6035
1985	244 6066	6097	6125	6156	6186	6217	6247	6278	6309	6339	6370	6400
1986	6431	6462	6490	6521	6551	6582	6612	6643	6674	6704	6735	6765
1987	6796	6827	6855	6886	6916	6947	6977	7008	7039	7069	7100	7130
1988	7161	7192	7221	7252	7282	7313	7343	7374	7405	7435	7466	7496
1989	7527	7558	7586	7617	7647	7678	7708	7739	7770	7800	7831	7861
1990	244 7892	7923	7951	7982	8012	8043	8073	8104	8135	8165	8196	8226
1991	8257	8288	8316	8347	8377	8408	8438	8469	8500	8530	8561	8591
1992	8622	8653	8682	8713	8743	8774	8804	8835	8866	8896	8927	8957
1993	8988	9019	9047	9078	9108	9139	9169	9200	9231	9261	9292	9322
1994	9353	9384	9412	9443	9473	9504	9534	9565	9596	9626	9657	9687
1995	244 9718	9749	9777	9808	9838	9869	9899	9930	9961	9991	*0022	*0052
1996	245 0083	0114	0143	0174	0204	0235	0265	0296	0327	0357	0388	0418
1997	0449	0480	0508	0539	0569	0600	0630	0661	0692	0722	0753	0783
1998	0814	0845	0873	0904	0934	0965	0995	1026	1057	1087	1118	1148
1999	1179	1210	1238	1269	1299	1330	1360	1391	1422	1452	1483	1513
2000	245 1544	1575	1604	1635	1665	1696	1726	1757	1788	1818	1849	1879

TABLE II
POLE STAR TABLE, 1960

L. S. T.	0 ^h		1 ^h		2 ^h		3 ^h		4 ^h		5 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m												
0	-48.2	+27.5	-53.7	+13.9	-55.4	- 0.7	-53.3	-15.3	-47.5	-28.8	-38.4	-40.2
3	48.6	26.9	53.8	13.2	55.4	1.5	53.1	16.0	47.1	29.4	37.9	40.7
6	48.9	26.2	54.0	12.5	55.4	2.2	52.9	16.7	46.7	30.0	37.3	41.2
9	49.3	25.6	54.2	11.7	55.3	3.0	52.6	17.4	46.3	30.7	36.8	41.7
12	49.6	24.9	54.3	11.0	55.3	3.7	52.4	18.1	45.9	31.3	36.2	42.2
15	-49.9	+24.3	-54.5	+10.3	-55.2	- 4.4	-52.2	-18.8	-45.5	-31.9	-35.7	-42.7
18	50.2	23.6	54.6	9.6	55.2	5.2	51.9	19.5	45.1	32.5	35.1	43.1
21	50.5	22.9	54.7	8.8	55.1	5.9	51.7	20.2	44.6	33.1	34.5	43.6
24	50.8	22.3	54.8	8.1	55.0	6.6	51.4	20.9	44.2	33.7	34.0	44.0
27	51.1	21.6	54.9	7.4	54.9	7.4	51.1	21.6	43.8	34.2	33.4	44.5
30	-51.4	+20.9	-55.0	+ 6.6	-54.8	- 8.1	-50.8	-22.3	-43.3	-34.8	-32.8	-44.9
33	51.7	20.2	55.1	5.9	54.7	8.8	50.5	22.9	42.8	35.4	32.2	45.3
36	51.9	19.5	55.2	5.2	54.6	9.6	50.2	23.6	42.4	35.9	31.6	45.7
39	52.2	18.8	55.2	4.4	54.5	10.3	49.9	24.3	41.9	36.5	31.0	46.2
42	52.4	18.1	55.3	3.7	54.3	11.0	49.6	24.9	41.4	37.1	30.4	46.6
45	-52.6	+17.4	-55.3	+ 3.0	-54.2	-11.7	-49.3	-25.6	-40.9	-37.6	-29.8	-46.9
48	52.9	16.7	55.4	2.2	54.0	12.5	48.9	26.2	40.4	38.1	29.2	47.3
51	53.1	16.0	55.4	1.5	53.8	13.2	48.6	26.9	39.9	38.7	28.6	47.7
54	53.3	15.3	55.4	+ 0.7	53.7	13.9	48.2	27.5	39.4	39.2	27.9	48.1
57	53.5	14.6	55.4	0.0	53.5	14.6	47.9	28.2	38.9	39.7	27.3	48.4
60	-53.7	+13.9	-55.4	- 0.7	-53.3	-15.3	-47.5	-28.8	-38.4	-40.2	-26.7	-48.8
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°												
0	- .1	- .4	.0	- .1	.0	+ .2	- .1	+ .4	- .2	+ .5	- .3	+ .5
10	- .1	- .3	.0	- .1	.0	+ .1	- .1	+ .3	- .2	+ .4	- .3	+ .4
20	.0	- .3	.0	- .1	.0	+ .1	- .1	+ .3	- .1	+ .4	- .2	+ .4
30	.0	- .2	.0	- .1	.0	+ .1	.0	+ .2	- .1	+ .3	- .2	+ .3
40	.0	- .1	.0	.0	.0	.0	.0	+ .1	- .1	+ .2	- .1	+ .2
45	.0	- .1	.0	.0	.0	.0	.0	+ .1	.0	+ .1	- .1	+ .1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+ .1	.0	.0	.0	.0	.0	- .1	.0	- .1	+ .1	- .1
60	.0	+ .2	.0	+ .1	.0	- .1	.0	- .2	+ .1	- .2	+ .2	- .2
62	.0	+ .2	.0	+ .1	.0	- .1	.0	- .2	+ .1	- .3	+ .2	- .3
64	+ .1	+ .3	.0	+ .1	.0	- .1	+ .1	- .3	+ .2	- .4	+ .2	- .4
66	+ .1	+ .3	.0	+ .1	.0	- .1	+ .1	- .3	+ .2	- .5	+ .3	- .5
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
Jan.	+ .3	- .3	+ .3	- .2	+ .4	- .1	+ .4	.0	+ .4	+ .1	+ .3	+ .2
Feb.	+ .2	- .4	+ .3	- .4	+ .4	- .2	+ .4	- .1	+ .4	.0	+ .4	+ .1
Mar.	+ .1	- .5	+ .2	- .4	+ .3	- .4	+ .4	- .3	+ .4	- .2	+ .5	- .1
Apr.	- .1	- .5	.0	- .5	+ .1	- .5	+ .2	- .4	+ .3	- .3	+ .4	- .2
May	- .2	- .4	- .1	- .4	.0	- .4	+ .1	- .4	+ .2	- .4	+ .3	- .3
June	- .3	- .2	- .2	- .3	- .1	- .3	.0	- .3	+ .1	- .3	+ .1	- .3
July	- .2	- .1	- .2	- .1	- .2	- .2	- .1	- .2	- .1	- .2	.0	- .2
Aug.	- .1	+ .1	- .1	.0	- .1	.0	- .1	.0	- .1	- .1	- .1	- .1
Sept.	+ .1	+ .2	.0	+ .2	.0	+ .2	- .1	+ .2	- .1	+ .1	- .1	+ .1
Oct.	+ .3	+ .1	+ .2	+ .2	+ .2	+ .3	+ .1	+ .3	.0	+ .3	- .1	+ .3
Nov.	+ .4	+ .1	+ .4	+ .2	+ .3	+ .3	+ .3	+ .4	+ .2	+ .4	.0	+ .4
Dec.	+ .5	- .1	+ .5	+ .1	+ .5	+ .2	+ .4	+ .4	+ .3	+ .4	+ .2	+ .5

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

POLE STAR TABLE, 1960

L. S. T.	6 ^h		7 ^h		8 ^h		9 ^h		10 ^h		11 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m												
0	-26.7	-48.8	-13.1	-54.0	+ 1.3	-55.4	+15.5	-53.0	+28.7	-47.2	+39.9	-38.1
3	26.0	49.1	12.4	54.1	2.0	55.4	16.2	52.8	29.3	46.8	40.4	37.6
6	25.4	49.5	11.7	54.3	2.7	55.3	16.9	52.6	29.9	46.4	40.9	37.1
9	24.7	49.8	11.0	54.4	3.4	55.3	17.6	52.4	30.6	46.0	41.4	36.5
12	24.1	50.1	10.3	54.5	4.2	55.2	18.3	52.1	31.2	45.6	41.9	36.0
15	-23.4	-50.4	- 9.6	-54.7	+ 4.9	-55.2	+19.0	-51.9	+31.7	-45.2	+42.4	-35.5
18	22.8	50.7	8.9	54.8	5.6	55.1	19.7	51.6	32.3	44.7	42.8	34.9
21	22.1	51.0	8.2	54.9	6.3	55.0	20.3	51.4	32.9	44.3	43.3	34.3
24	21.4	51.3	7.4	55.0	7.0	54.9	21.0	51.1	33.5	43.9	43.7	33.8
27	20.8	51.6	6.7	55.1	7.8	54.8	21.7	50.8	34.1	43.4	44.2	33.2
30	-20.1	-51.8	- 6.0	-55.2	+ 8.5	-54.7	+22.3	-50.5	+34.6	-43.0	+44.6	-32.6
33	19.4	52.1	5.3	55.2	9.2	54.6	23.0	50.2	35.2	42.5	45.0	32.1
36	18.7	52.3	4.5	55.3	9.9	54.4	23.6	49.9	35.7	42.1	45.4	31.5
39	18.0	52.6	3.8	55.3	10.6	54.3	24.3	49.6	36.3	41.6	45.8	30.9
42	17.3	52.8	3.1	55.4	11.3	54.1	24.9	49.3	36.8	41.1	46.2	30.3
45	-16.6	-53.0	- 2.4	-55.4	+12.0	-54.0	+25.6	-48.9	+37.4	-40.6	+46.6	-29.7
48	15.9	53.2	1.7	55.4	12.7	53.8	26.2	48.6	37.9	40.2	47.0	29.1
51	15.2	53.4	0.9	55.4	13.4	53.6	26.8	48.3	38.4	39.7	47.4	28.5
54	14.5	53.6	- 0.2	55.4	14.1	53.4	27.5	47.9	38.9	39.2	47.8	27.9
57	13.8	53.8	+ 0.5	55.4	14.8	53.2	28.1	47.5	39.4	38.6	48.1	27.2
60	-13.1	-54.0	+ 1.3	-55.4	+15.5	-53.0	+28.7	-47.2	+39.9	-38.1	+48.5	-26.6
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°												
0	-5	+4	-5	+1	-5	-2	-4	-4	-3	-5	-2	-5
10	-4	+3	-4	+1	-4	-1	-4	-3	-3	-4	-2	-4
20	-3	+3	-4	+1	-4	-1	-3	-3	-2	-4	-1	-4
30	-2	+2	-3	+1	-3	-1	-2	-2	-2	-3	-1	-3
40	-1	+1	-2	0	-2	0	-1	-1	-1	-2	-1	-2
45	-1	+1	-1	0	-1	0	-1	-1	-1	-1	0	-1
50	0	0	0	0	0	0	0	0	0	0	0	0
55	+1	-1	+1	0	+1	0	+1	+1	+1	+1	0	+1
60	+2	-2	+2	-1	+2	+1	+2	+2	+1	+2	+1	+2
62	+3	-2	+3	-1	+3	+1	+3	+2	+2	+3	+1	+3
64	+3	-3	+4	-1	+4	+1	+3	+3	+2	+4	+1	+4
66	+4	-3	+5	-1	+5	+1	+4	+3	+3	+5	+2	+5
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
Jan.	+3	+3	+2	+3	+1	+4	0	+4	-1	+4	-2	+3
Feb.	+4	+2	+4	+3	+2	+4	+1	+4	0	+4	-1	+4
Mar.	+5	+1	+4	+2	+4	+3	+3	+4	+2	+4	+1	+5
Apr.	+5	-1	+5	0	+5	+1	+4	+2	+3	+3	+2	+4
May	+4	-2	+4	-1	+4	0	+4	+1	+4	+2	+3	+3
June	+2	-3	+3	-2	+3	-1	+3	0	+3	+1	+3	+1
July	+1	-2	+1	-2	+2	-2	+2	-1	+2	-1	+2	0
Aug.	-1	-1	0	-1	0	-1	0	-1	+1	-1	+1	-1
Sept.	-2	+1	-2	0	-2	0	-2	-1	-1	-1	-1	-1
Oct.	-1	+3	-2	+2	-3	+2	-3	+1	-3	0	-3	-1
Nov.	-1	+4	-2	+4	-3	+3	-4	+3	-4	+2	-4	0
Dec.	+1	+5	-1	+5	-2	+5	-4	+4	-4	+3	-5	+2

Latitude of observer is sum of corrected observed altitude of Polaris and ($a_0+a_1+a_2$).

Azimuth of Polaris is product of ($b_0+b_1+b_2$) by secant of latitude.

TABLE II
POLE STAR TABLE, 1960

L. S. T.	12 ^h		13 ^h		14 ^h		15 ^h		16 ^h		17 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m												
0	+48.5	-26.6	+53.7	-13.4	+55.4	+ 0.7	+53.4	+14.8	+47.8	+27.9	+38.9	+39.2
3	48.8	26.0	53.9	12.7	55.4	1.4	53.2	15.4	47.4	28.5	38.4	39.7
6	49.1	25.4	54.1	12.0	55.4	2.1	53.0	16.1	47.0	29.1	37.9	40.2
9	49.5	24.7	54.2	11.3	55.3	2.8	52.7	16.8	46.6	29.7	37.4	40.6
12	49.8	24.1	54.4	10.6	55.3	3.6	52.5	17.5	46.2	30.3	36.8	41.1
15	+50.1	-23.4	+54.5	- 9.9	+55.2	+ 4.3	+52.3	+18.2	+45.8	+30.9	+36.3	+41.6
18	50.4	22.8	54.6	9.2	55.2	5.0	52.0	18.8	45.4	31.5	35.7	42.1
21	50.7	22.1	54.7	8.5	55.1	5.7	51.8	19.5	45.0	32.1	35.2	42.5
24	51.0	21.5	54.8	7.8	55.0	6.4	51.5	20.2	44.6	32.6	34.6	43.0
27	51.3	20.8	54.9	7.1	54.9	7.1	51.3	20.8	44.2	33.2	34.1	43.4
30	+51.5	-20.2	+55.0	- 6.4	+54.8	+ 7.8	+51.0	+21.5	+43.7	+33.8	+33.5	+43.9
33	51.8	19.5	55.1	5.7	54.7	8.5	50.7	22.1	43.3	34.3	32.9	44.3
36	52.0	18.8	55.2	5.0	54.6	9.2	50.4	22.8	42.8	34.9	32.3	44.7
39	52.3	18.2	55.2	4.3	54.5	9.9	50.1	23.4	42.4	35.5	31.7	45.2
42	52.5	17.5	55.3	3.6	54.4	10.6	49.8	24.1	41.9	36.0	31.2	45.6
45	+52.7	-16.8	+55.3	- 2.8	+54.2	+11.3	+49.5	+24.7	+41.4	+36.5	+30.6	+46.0
48	53.0	16.1	55.4	2.1	54.1	12.0	49.1	25.4	40.9	37.1	29.9	46.4
51	53.2	15.4	55.4	1.4	53.9	12.7	48.8	26.0	40.4	37.6	29.3	46.8
54	53.4	14.8	55.4	- 0.7	53.7	13.4	48.5	26.6	39.9	38.1	28.7	47.2
57	53.6	14.1	55.4	0.0	53.6	14.1	48.1	27.2	39.4	38.6	28.1	47.5
60	+53.7	-13.4	+55.4	+ 0.7	+53.4	+14.8	+47.8	+27.9	+38.9	+39.2	+27.5	+47.9
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°												
0	- .1	- .4	.0	- .1	.0	+ .2	- .1	+ .4	- .2	+ .5	- .3	+ .5
10	- .1	- .3	.0	- .1	.0	+ .1	- .1	+ .3	- .2	+ .4	- .3	+ .4
20	.0	- .3	.0	- .1	.0	+ .1	- .1	+ .3	- .1	+ .4	- .2	+ .4
30	.0	- .2	.0	- .1	.0	+ .1	.0	+ .2	- .1	+ .3	- .2	+ .3
40	.0	- .1	.0	.0	.0	.0	.0	+ .1	- .1	+ .2	- .1	+ .2
45	.0	- .1	.0	.0	.0	.0	.0	+ .1	.0	+ .1	- .1	+ .1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+ .1	.0	.0	.0	.0	.0	- .1	.0	- .1	+ .1	- .1
60	.0	+ .2	.0	+ .1	.0	- .1	.0	- .2	+ .1	- .2	+ .2	- .2
62	.0	+ .2	.0	+ .1	.0	- .1	.0	- .2	+ .1	- .3	+ .2	- .3
64	+ .1	+ .3	.0	+ .1	.0	- .1	+ .1	- .3	+ .2	- .4	+ .2	- .4
66	+ .1	+ .3	.0	+ .1	.0	- .1	+ .1	- .3	+ .2	- .5	+ .3	- .5
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
Jan.	- .3	+ .3	- .3	+ .2	- .4	+ .1	- .4	.0	- .4	- .1	- .3	- .2
Feb.	- .2	+ .4	- .3	+ .4	- .4	+ .2	- .4	+ .1	- .4	.0	- .4	- .1
Mar.	- .1	+ .5	- .2	+ .4	- .3	+ .4	- .4	+ .3	- .4	+ .2	- .5	+ .1
Apr.	+ .1	+ .5	.0	+ .5	- .1	+ .5	- .2	+ .4	- .3	+ .3	- .4	+ .2
May	+ .2	+ .4	+ .1	+ .4	.0	+ .4	- .1	+ .4	- .2	+ .4	- .3	+ .3
June	+ .3	+ .2	+ .2	+ .3	+ .1	+ .3	.0	+ .3	- .1	+ .3	- .1	+ .3
July	+ .2	+ .1	+ .2	+ .1	+ .2	+ .2	+ .1	+ .2	+ .1	+ .2	.0	+ .2
Aug.	+ .1	- .1	+ .1	.0	+ .1	.0	+ .1	.0	+ .1	+ .1	+ .1	+ .1
Sept.	- .1	- .2	.0	- .2	.0	- .2	+ .1	- .2	+ .1	- .1	+ .1	- .1
Oct.	- .3	- .1	- .2	- .2	- .2	- .3	- .1	- .3	.0	- .3	+ .1	- .3
Nov.	- .4	- .1	- .4	- .2	- .3	- .3	- .3	- .4	- .2	- .4	.0	- .4
Dec.	- .5	+ .1	- .5	- .1	- .5	- .2	- .4	- .4	- .3	- .4	- .2	- .5

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

POLE STAR TABLE, 1960

L. S. T.	18 ^h		19 ^h		20 ^h		21 ^h		22 ^h		23 ^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m												
0	+27.5	+47.9	+14.1	+53.4	- 0.2	+55.4	-14.5	+53.6	-27.9	+48.1	-39.4	+39.2
3	26.8	48.3	13.4	53.6	0.9	55.4	15.2	53.4	28.6	47.7	39.9	38.7
6	26.2	48.6	12.7	53.8	1.7	55.4	15.9	53.2	29.2	47.3	40.4	38.1
9	25.6	48.9	12.0	54.0	2.4	55.4	16.6	53.0	29.8	46.9	40.9	37.6
12	24.9	49.3	11.3	54.1	3.1	55.4	17.3	52.8	30.4	46.6	41.4	37.1
15	+24.3	+49.6	+10.6	+54.3	- 3.8	+55.3	-18.0	+52.6	-31.0	+46.2	-41.9	+36.5
18	23.6	49.9	9.9	54.4	4.5	55.3	18.7	52.3	31.6	45.7	42.4	35.9
21	23.0	50.2	9.2	54.6	5.3	55.2	19.4	52.1	32.2	45.3	42.8	35.4
24	22.3	50.5	8.5	54.7	6.0	55.2	20.1	51.8	32.8	44.9	43.3	34.8
27	21.7	50.8	7.8	54.8	6.7	55.1	20.8	51.6	33.4	44.5	43.8	34.2
30	+21.0	+51.1	+ 7.0	+54.9	- 7.4	+55.0	-21.4	+51.3	-34.0	+44.0	-44.2	+33.7
33	20.3	51.4	6.3	55.0	8.2	54.9	22.1	51.0	34.5	43.6	44.6	33.1
36	19.7	51.6	5.6	55.1	8.9	54.8	22.8	50.7	35.1	43.1	45.1	32.5
39	19.0	51.9	4.9	55.2	9.6	54.7	23.4	50.4	35.7	42.7	45.5	31.9
42	18.3	52.1	4.2	55.2	10.3	54.5	24.1	50.1	36.2	42.2	45.9	31.3
45	+17.6	+52.4	+ 3.4	+55.3	-11.0	+54.4	-24.7	+49.8	-36.8	+41.7	-46.3	+30.7
48	16.9	52.6	2.7	55.3	11.7	54.3	25.4	49.5	37.3	41.2	46.7	30.0
51	16.2	52.8	2.0	55.4	12.4	54.1	26.0	49.1	37.9	40.7	47.1	29.4
54	15.5	53.0	1.3	55.4	13.1	54.0	26.7	48.8	38.4	40.2	47.5	28.8
57	14.8	53.2	+ 0.5	55.4	13.8	53.8	27.3	48.4	38.9	39.7	47.9	28.2
60	+14.1	+53.4	- 0.2	+55.4	-14.5	+53.6	-27.9	+48.1	-39.4	+39.2	-48.2	+27.5
Lat.	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
°												
0	- .5	+ .4	- .5	+ .1	- .5	- .2	- .4	- .4	- .3	- .5	- .2	- .5
10	- .4	+ .3	- .4	+ .1	- .4	- .1	- .4	- .3	- .3	- .4	- .2	- .4
20	- .3	+ .3	- .4	+ .1	- .4	- .1	- .3	- .3	- .2	- .4	- .1	- .4
30	- .2	+ .2	- .3	+ .1	- .3	- .1	- .2	- .2	- .2	- .3	- .1	- .3
40	- .1	+ .1	- .2	. 0	- .2	. 0	- .1	- .1	- .1	- .2	- .1	- .2
45	- .1	+ .1	- .1	. 0	- .1	. 0	- .1	- .1	- .1	- .1	. 0	- .1
50	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0
55	+ .1	- .1	+ .1	. 0	+ .1	. 0	+ .1	+ .1	+ .1	+ .1	. 0	+ .1
60	+ .2	- .2	+ .2	- .1	+ .2	+ .1	+ .2	+ .2	+ .1	+ .2	+ .1	+ .2
62	+ .3	- .2	+ .3	- .1	+ .3	+ .1	+ .3	+ .2	+ .2	+ .3	+ .1	+ .3
64	+ .3	- .3	+ .4	- .1	+ .4	+ .1	+ .3	+ .3	+ .2	+ .4	+ .1	+ .4
66	+ .4	- .3	+ .5	- .1	+ .5	+ .1	+ .4	+ .3	+ .3	+ .5	+ .2	+ .5
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	- .3	- .3	- .2	- .3	- .1	- .4	. 0	- .4	+ .1	- .4	+ .2	- .3
Feb.	- .4	- .2	- .4	- .3	- .2	- .4	- .1	- .4	. 0	- .4	+ .1	- .4
Mar.	- .5	- .1	- .4	- .2	- .4	- .3	- .3	- .4	- .2	- .4	- .1	- .5
Apr.	- .5	+ .1	- .5	. 0	- .5	- .1	- .4	- .2	- .3	- .3	- .2	- .4
May	- .4	+ .2	- .4	+ .1	- .4	. 0	- .4	- .1	- .4	- .2	- .3	- .3
June	- .2	+ .3	- .3	+ .2	- .3	+ .1	- .3	. 0	- .3	- .1	- .3	- .1
July	- .1	+ .2	- .1	+ .2	- .2	+ .2	- .2	+ .1	- .2	+ .1	- .2	. 0
Aug.	+ .1	+ .1	. 0	+ .1	. 0	+ .1	. 0	+ .1	- .1	+ .1	- .1	+ .1
Sept.	+ .2	- .1	+ .2	. 0	+ .2	. 0	+ .2	+ .1	+ .1	+ .1	+ .1	+ .1
Oct.	+ .1	- .3	+ .2	- .2	+ .3	- .2	+ .3	- .1	+ .3	. 0	+ .3	+ .1
Nov.	+ .1	- .4	+ .2	- .4	+ .3	- .3	+ .4	- .3	+ .4	- .2	+ .4	. 0
Dec.	- .1	- .5	+ .1	- .5	+ .2	- .5	+ .4	- .4	+ .4	- .3	+ .5	- .2

Latitude of observer is sum of corrected observed altitude of Polaris and $(a_0 + a_1 + a_2)$.

Azimuth of Polaris is product of $(b_0 + b_1 + b_2)$ by secant of latitude.

CONSTANTS FOR THE REDUCTION OF THE MEAN PLACES OF STARS
FROM THE EQUINOX OF t_0 TO THAT OF $t=1960.0$

t_0	ζ_0	z	θ	t_0	M	N	
	' "	' "	' "		^s	^s	"
1755	+78 40.99	+78 44.32	+68 29.99	1755	+629.67	+274.02	+4110.3
1790	65 15.58	65 17.87	56 48.12	1790	522.22	227.22	3408.3
1800	61 25.42	61 27.44	53 27.60	1800	491.51	213.85	3207.8
1810	57 35.23	57 37.01	50 07.08	1810	460.81	200.48	3007.2
1825	51 49.92	51 51.36	45 06.31	1825	414.75	180.43	2706.4
1830	+49 54.81	+49 56.14	+43 26.05	1830	+399.39	+173.74	+2606.1
1835	47 59.69	48 00.92	41 45.80	1835	384.04	167.06	2505.9
1840	46 04.56	46 05.70	40 05.55	1840	368.68	160.37	2405.6
1845	44 09.43	44 10.48	38 25.30	1845	353.32	153.69	2305.4
1850	42 14.30	42 15.26	36 45.05	1850	337.97	147.01	2205.1
1855	+40 19.16	+40 20.03	+35 04.80	1855	+322.61	+140.32	+2104.8
1860	38 24.01	38 24.80	33 24.56	1860	307.25	133.64	2004.6
1865	36 28.86	36 29.58	31 44.31	1865	291.89	126.96	1904.3
1870	34 33.71	34 34.35	30 04.07	1870	276.54	120.27	1804.1
1875	32 38.55	32 39.12	28 23.83	1875	261.18	113.59	1703.9
1880	+30 43.38	+30 43.89	+26 43.59	1880	+245.82	+106.91	+1603.6
1885	28 48.21	28 48.65	25 03.35	1885	230.46	100.22	1503.4
1890	26 53.03	26 53.42	23 23.11	1890	215.10	93.54	1403.1
1895	24 57.85	24 58.18	21 42.88	1895	199.74	86.86	1302.9
1900	23 02.66	23 02.95	20 02.65	1900	184.37	80.18	1202.7
1905	+21 07.47	+21 07.71	+18 22.42	1905	+169.01	+ 73.49	+1102.4
1910	19 12.27	19 12.47	16 42.19	1910	153.65	66.81	1002.2
1915	17 17.07	17 17.23	15 01.96	1915	138.29	60.13	902.0
1920	15 21.86	15 21.99	13 21.73	1920	122.92	53.45	801.7
1925	13 26.65	13 26.74	11 41.51	1925	107.56	46.77	701.5
1930	+11 31.43	+11 31.50	+10 01.29	1930	+ 92.20	+ 40.09	+ 601.3
1935	9 36.20	9 36.25	8 21.07	1935	76.83	33.40	501.1
1940	7 40.97	7 41.01	6 40.85	1940	61.47	26.72	400.9
1945	5 45.74	5 45.76	5 00.64	1945	46.10	20.04	300.6
1950	3 50.50	3 50.51	3 20.42	1950	30.73	13.36	200.4
1955	+ 1 55.25	+ 1 55.25	+ 1 40.21	1955	+ 15.37	+ 6.68	+ 100.2

APPROXIMATE REDUCTION FROM THE STANDARD EQUINOX OF
1950.0 TO THE TRUE EQUINOX, 1960

δ	$4 \tan \delta$	Date	f	g	G	Date	f	g	G
$^{\circ}$			$^{\circ}$	$'$	$^{\text{h}}$ $^{\text{m}}$		$^{\circ}$	$'$	$^{\text{h}}$ $^{\text{m}}$
0	0.00	Jan - 3	+30.7	3.34	0 12	June 25	+32.0	3.48	0 11
1	0.07	7	30.8	3.35	0 11	July 5*	32.1	3.49	0 11
2	0.14	17	30.9	3.36	0 11	15	32.2	3.50	0 11
3	0.21	27*	31.0	3.37	0 11	25	32.3	3.51	0 10
4	0.28	Feb. 6	31.1	3.38	0 11	Aug. 4	32.4	3.52	0 10
5	0.35	16	+31.1	3.39	0 10	14*	+32.4	3.53	0 10
6	0.42	26	31.2	3.39	0 10	24	32.5	3.54	0 10
7	0.49	Mar. 7*	31.2	3.40	0 10	Sept. 3	32.6	3.54	0 10
8	0.56	17	31.3	3.40	0 10	13	32.6	3.55	0 09
9	0.63	27	31.3	3.41	0 10	23*†	32.7	3.55	0 09
10	0.71	Apr. 6	+31.4	3.42	0 10	Oct. 3	+32.7	3.56	0 09
11	0.78	16*	31.4	3.42	0 10	13	32.8	3.57	0 09
12	0.85	26	31.5	3.43	0 10	23	32.8	3.57	0 10
13	0.92	May 6	31.6	3.43	0 10	Nov. 2*	32.9	3.58	0 10
14	1.00	16	31.7	3.44	0 11	12	33.0	3.59	0 10
15	1.07	26*	+31.7	3.45	0 11	22	+33.1	3.60	0 10
16	1.15	June 5	31.8	3.46	0 11	Dec. 2	33.1	3.61	0 10
17	1.22	15	31.9	3.47	0 11	12*	33.2	3.62	0 10
18	1.30	25	32.0	3.48	0 11	22	33.4	3.63	0 10
19	1.38	July 5*	+32.1	3.49	0 11	32	+33.5	3.64	0 10
20	1.46	*40-day ephemeris date							
21	1.54	†400-day date for osculation epoch							
22	1.62								
23	1.70								
24	1.78	$4 \tan \delta$							
		δ	0'	10'	20'	30'	40'	50'	60'
		$^{\circ}$							
25	1.87	45	4.00	4.02	4.05	4.07	4.09	4.12	4.14
26	1.95	46	4.14	4.17	4.19	4.22	4.24	4.26	4.29
27	2.04	47	4.29	4.32	4.34	4.36	4.39	4.42	4.44
28	2.13	48	4.44	4.47	4.49	4.52	4.55	4.57	4.60
29	2.22	49	4.60	4.63	4.66	4.68	4.71	4.74	4.77
30	2.31	50	4.77	4.80	4.82	4.85	4.88	4.91	4.94
31	2.40	51	4.94	4.97	5.00	5.03	5.06	5.09	5.12
32	2.50	52	5.12	5.15	5.18	5.21	5.24	5.28	5.31
33	2.60	53	5.31	5.34	5.37	5.41	5.44	5.47	5.51
34	2.70	54	5.51	5.54	5.57	5.61	5.64	5.68	5.71
35	2.80	55	5.71	5.75	5.78	5.82	5.86	5.89	5.93
36	2.91	56	5.93	5.97	6.01	6.04	6.08	6.12	6.16
37	3.02	57	6.16	6.20	6.24	6.28	6.32	6.36	6.40
38	3.13	58	6.40	6.44	6.48	6.53	6.57	6.61	6.66
39	3.24	59	6.66	6.70	6.75	6.79	6.84	6.88	6.93
40	3.36	60	6.93	6.98	7.02	7.07	7.12	7.17	7.22
41	3.48	61	7.22	7.27	7.32	7.37	7.42	7.47	7.52
42	3.60	62	7.52	7.58	7.63	7.68	7.74	7.79	7.85
43	3.73	63	7.85	7.91	7.97	8.02	8.08	8.14	8.20
44	3.86	64	8.20	8.26	8.32	8.39	8.45	8.51	8.58
45	4.00	65	8.58	8.64	8.71	8.78	8.85	8.91	8.98

$$\alpha_{\text{Date}} = \alpha_{1950} + f + g \sin (G + \alpha_{1950}) \tan \delta_{1950}$$

$$\delta_{\text{Date}} = \delta_{1950} + g \cos (G + \alpha_{1950})$$

In the formula for α , the last term is to be expressed in seconds of time by multiplying g in minutes of arc by 4, where the factor 4 is applied by using the tabular value of $4 \tan \delta$.

DIFFERENTIAL ABERRATION

The correction for differential stellar aberration to be *added* to the observed differences $\Delta\alpha$ and $\Delta\delta$ of the right ascension and declination of an object relative to a comparison star, measured in the sense object *minus* star in units of 1^m and 1' respectively, to obtain the true differences, is:

In right ascension, $a\Delta\alpha + b\frac{\Delta\delta}{10}$ in units of 0.001,

In declination, $c\Delta\alpha + d\frac{\Delta\delta}{10}$ in units of 0".01,

where *a*, *b*, *c*, *d*, are obtained from the table below with arguments *H*+ α and δ , and may in general be taken out without interpolation; for the signs, see opposite page.

Date	<i>H</i>	Date	<i>H</i>	Date	<i>H</i>	Date	<i>H</i>	Date	<i>H</i>
Dec. 26	^b 23.5	Feb. 25	^b 19.5	Apr. 22	^b 15.5	June 26	^b 11.5	Aug. 29	^b 7.5
Jan. 3	23.0	Mar. 4	19.0	29	15.0	5	11.0	6	7.0
11	22.5	11	18.5	May 7	14.5	13	10.5	13	6.5
19	22.0	17	18.0	15	14.0	21	10.0	20	6.0
26	21.5	24	17.5	23	13.5	29	9.5	27	5.5
Feb. 3	21.0	31	17.0	31	13.0	Aug. 6	9.0	4	5.0
10	20.5	Apr. 7	16.5	June 9	12.5	14	8.5	11	4.5
17	20.0	15	16.0	17	12.0	22	8.0	18	4.0
25		22		26		29		25	

In critical cases ascend.

δ	0°				10°				20°				30°				40°				δ
<i>H</i> + α	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>H</i> + α
^b 0	-6	0	0	-6	-6	0	0	-6	-6	0	0	-5	-7	0	0	-5	-7	0	0	-4	^b 24
1	6	0	0	6	6	0	0	5	6	0	1	5	6	1	1	5	7	1	1	4	23
2	5	0	0	5	5	0	1	5	5	1	1	5	6	1	2	4	6	2	3	4	22
3	4	0	0	4	4	0	1	4	4	1	2	4	5	2	3	3	5	3	4	3	21
4	3	0	0	3	3	1	1	3	3	1	3	3	3	2	4	2	4	4	5	2	20
5	-1	0	0	-1	-1	1	1	-1	-2	1	3	-1	-2	2	4	-1	-2	4	5	-1	19
6	0	0	0	0	0	1	1	0	0	1	3	0	0	3	4	0	0	4	5	0	18
7	+1	0	0	+1	+1	1	1	+1	+2	1	3	+1	+2	2	4	+1	+2	4	5	+1	17
8	3	0	0	3	3	1	1	3	3	1	3	3	3	2	4	2	4	4	5	2	16
9	4	0	0	4	4	0	1	4	4	1	2	4	5	2	3	3	5	3	4	3	15
10	5	0	0	5	5	0	1	5	5	1	1	5	6	1	2	4	6	2	3	4	14
11	6	0	0	6	6	0	0	5	6	0	1	5	6	1	1	5	7	1	1	4	13
12	+6	0	0	+6	+6	0	0	+6	+6	0	0	+5	+7	0	0	+5	+7	0	0	+4	12
						+	-			+	-			+	-			+	-		
δ	45°				50°				55°				60°				65°				δ
^b 0	-8	0	0	-4	-9	0	0	-4	-10	0	0	-3	-11	0	0	-3	-13	0	0	-2	^b 24
1	8	1	2	4	9	2	2	4	10	2	2	3	11	3	2	3	13	5	2	2	23
2	7	3	3	3	8	4	3	3	9	5	4	3	10	7	4	2	12	10	4	2	22
3	6	4	4	3	6	5	5	3	7	7	5	2	8	9	5	2	10	14	5	2	21
4	4	5	5	2	4	6	6	2	5	8	6	2	6	11	6	1	7	17	7	1	20
5	-2	5	6	-1	-2	7	6	-1	-3	9	7	-1	-3	13	7	-1	-3	19	7	-1	19
6	0	5	6	0	0	7	7	0	0	9	7	0	0	13	7	0	0	19	8	0	18
7	+2	5	6	+1	+2	7	6	+1	+3	9	7	+1	+3	13	7	+1	+3	19	7	+1	17
8	4	5	5	2	4	6	6	2	5	8	6	2	6	11	6	1	7	17	7	1	16
9	6	4	4	3	6	5	5	3	7	7	5	2	8	9	5	2	10	14	5	2	15
10	7	3	3	3	8	4	3	3	9	5	4	3	10	7	4	2	12	10	4	2	14
11	8	1	2	4	9	2	2	4	10	2	2	3	11	3	2	3	13	5	2	2	13
12	+8	0	0	+4	+9	0	0	+4	+10	0	0	+3	+11	0	0	+3	+13	0	0	+2	12
		+	-			+	-			+	-			+	-			+	-		

DIFFERENTIAL ABERRATION

For positive declinations, take the signs of b and c (which are always opposite) from the top of the column when the argument $H+\alpha$ is on the left, from the bottom when $H+\alpha$ is on the right. For negative declinations, reverse the signs of b and c .

The signs of a and d (which are always alike) are independent of the sign of δ , and also of whether $H+\alpha$ is on the left or the right.

δ	62°				64°				66°				68°				70°				δ
$H+\alpha$	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	$H+\alpha$
^b 0	-12	0	0	-3	-13	0	0	-2	-14	0	0	-2	-15	0	0	-2	-17	0	0	-2	^b 24
1	12	4	2	3	13	5	2	2	14	5	2	2	15	6	2	2	16	8	2	2	23
2	11	8	4	2	11	9	4	2	12	10	4	2	13	13	4	2	14	15	4	2	22
3	9	11	5	2	9	13	5	2	10	15	6	2	11	18	6	2	12	22	6	1	21
4	6	13	7	1	7	15	7	1	7	18	7	1	8	22	7	1	8	26	7	1	20
5	-3	15	7	-1	-3	17	7	-1	-4	20	8	-1	-4	24	8	-1	-4	29	8	-1	19
6	0	15	8	0	0	18	8	0	0	21	8	0	0	25	8	0	0	31	8	0	18
7	+3	15	7	+1	+3	17	7	+1	+4	20	8	+1	+4	24	8	+1	+4	29	8	+1	17
8	6	13	7	1	7	15	7	1	7	18	7	1	8	22	7	1	8	26	7	1	16
9	9	11	5	2	9	13	5	2	10	15	6	2	11	18	6	2	12	22	6	1	15
10	11	8	4	2	11	9	4	2	12	10	4	2	13	13	4	2	14	15	4	2	14
11	12	4	2	3	13	5	2	2	14	5	2	2	15	6	2	2	16	8	2	2	13
12	+12	0	0	+3	+13	0	0	+2	+14	0	0	+2	+15	0	0	+2	+17	0	0	+2	12
		+	-			+	-			+	-			+	-			+	-		
δ	71°				72°				73°				74°				75°				δ
^b 0.0	-18	0	0	-2	-18	0	0	-2	-20	0	0	-2	-21	0	0	-2	-22	0	0	-1	^b 24.0
0.5	17	4	1	2	18	5	1	2	19	6	1	2	21	6	1	2	22	7	1	1	23.5
1.0	17	9	2	2	18	10	2	2	19	11	2	2	20	12	2	2	21	14	2	1	23.0
1.5	16	13	3	2	17	15	3	2	18	16	3	2	19	18	3	1	20	21	3	1	22.5
2.0	15	17	4	2	16	19	4	2	17	21	4	1	18	24	4	1	19	27	4	1	22.0
2.5	14	21	5	1	15	23	5	1	15	26	5	1	16	29	5	1	17	33	5	1	21.5
3.0	-12	24	6	-1	-13	27	6	-1	-14	30	6	-1	-15	34	6	-1	-16	39	6	-1	21.0
3.5	11	27	6	1	11	30	6	1	12	34	6	1	13	38	7	1	13	43	7	1	20.5
4.0	9	29	7	1	9	33	7	1	10	37	7	1	10	42	7	1	11	48	7	1	20.0
4.5	7	31	7	-1	7	35	8	-1	8	39	8	-1	8	44	8	-1	8	51	8	-1	19.5
5.0	5	33	8	0	5	37	8	0	5	41	8	0	5	46	8	0	6	53	8	0	19.0
5.5	-2	34	8	0	-2	38	8	0	-3	42	8	0	-3	48	8	0	-3	54	8	0	18.5
6.0	0	34	8	0	0	38	8	0	0	43	8	0	0	48	8	0	0	55	8	0	18.0
6.5	+2	34	8	0	+2	38	8	0	+3	42	8	0	+3	48	8	0	+3	54	8	0	17.5
7.0	5	33	8	0	5	37	8	0	5	41	8	0	5	46	8	0	6	53	8	0	17.0
7.5	7	31	7	+1	7	35	8	+1	8	39	8	+1	8	44	8	+1	8	51	8	+1	16.5
8.0	9	29	7	1	9	33	7	1	10	37	7	1	10	42	7	1	11	48	7	1	16.0
8.5	11	27	6	1	11	30	6	1	12	34	6	1	13	38	7	1	13	43	7	1	15.5
9.0	12	24	6	1	13	27	6	1	14	30	6	1	15	34	6	1	16	39	6	1	15.0
9.5	+14	21	5	+1	+15	23	5	+1	+15	26	5	+1	+16	29	5	+1	+17	33	5	+1	14.5
10.0	15	17	4	2	16	19	4	2	17	21	4	1	18	24	4	1	19	27	4	1	14.0
10.5	16	13	3	2	17	15	3	2	18	16	3	2	19	18	3	1	20	21	3	1	13.5
11.0	17	9	2	2	18	10	2	2	19	11	2	2	20	12	2	2	21	14	2	1	13.0
11.5	17	4	1	2	18	5	1	2	19	6	1	2	21	6	1	2	22	7	1	1	12.5
12.0	+18	0	0	+2	+18	0	0	+2	+20	0	0	+2	+21	0	0	+2	+22	0	0	+1	12.0
		+	-			+	-			+	-			+	-			+	-		

DIFFERENTIAL PRECESSION AND NUTATION, 1960

The correction for differential precession and nutation to be *added* to the observed differences $\Delta\alpha$ and $\Delta\delta$ of the right ascension and declination of an object relative to a comparison star, measured in the sense object *minus* star in units of 1^m and 1' respectively, is:

In right ascension, $e\Delta\alpha \frac{10 \tan \delta}{15} - f\Delta\delta \frac{10 \sec^2 \delta}{225}$, units of 0.001;
in declination, $f\Delta\alpha$, units of 0.01;

where *e* and *f* are taken from the table below, with the signs given in the table when $0^h \leq \alpha \leq 12^h$, but with the opposite signs when $12^h \leq \alpha \leq 24^h$.

	Jan. 1		Apr. 1		July 1		Oct. 1		Dec. 32			δ	10 tan δ 15	10 sec ² δ 225							
α	FOR REDUCTION TO 1950.0										α	$^{\circ}$									
h	e	f	e	f	e	f	e	f	e	f	h	0									
0.0	-87	+ 4	-89	+ 4	-91	+ 4	-93	+ 4	-95	+ 4	12.0	5	0.00	0.04							
0.5	-86	+16	-88	+16	-90	+16	-92	+16	-94	+17	12.5	10	0.06	.04							
1.0	-83	+27	-85	+27	-87	+28	-89	+28	-91	+29	13.0	15	0.12	.05							
1.5	-79	+38	-81	+38	-83	+39	-85	+39	-86	+40	13.5	20	0.18	.05							
2.0	-74	+48	-75	+48	-77	+49	-79	+50	-80	+51	14.0	25	0.24	0.05							
2.5	-67	+57	-68	+57	-70	+59	-72	+60	-73	+61	14.5	30	0.31	.05							
											35	30	0.38	.06							
3.0	-59	+65	-60	+66	-62	+68	-63	+69	-64	+70	15.0	35	0.47	.07							
3.5	-50	+72	-51	+73	-52	+75	-54	+76	-55	+78	15.5	40	0.56	0.08							
4.0	-40	+78	-41	+79	-42	+81	-43	+82	-44	+85	16.0	41	0.58	.08							
4.5	-29	+83	-31	+84	-31	+86	-32	+87	-33	+90	16.5	42	0.60	.08							
5.0	-18	+86	-19	+87	-19	+89	-20	+91	-21	+93	17.0	43	0.62	.08							
5.5	- 7	+87	- 8	+89	- 8	+91	- 8	+93	- 8	+95	17.5	44	0.64	.09							
6.0	+ 4	+87	+ 4	+89	+ 4	+91	+ 4	+93	+ 4	+95	18.0	45	0.67	0.09							
6.5	+16	+86	+16	+88	+16	+90	+16	+92	+17	+94	18.5	46	0.69	.09							
7.0	+27	+83	+27	+85	+28	+87	+28	+89	+29	+91	19.0	47	0.71	.10							
7.5	+38	+79	+38	+81	+39	+83	+39	+85	+40	+86	19.5	48	0.74	.10							
8.0	+48	+74	+48	+75	+49	+77	+50	+79	+51	+80	20.0	49	0.77	.10							
8.5	+57	+67	+57	+68	+59	+70	+60	+72	+61	+73	20.5	50	0.79	0.11							
9.0	+65	+59	+66	+60	+68	+62	+69	+63	+70	+64	21.0	51	0.82	.11							
9.5	+72	+50	+73	+51	+75	+52	+76	+54	+78	+55	21.5	52	0.85	.12							
10.0	+78	+40	+79	+41	+81	+42	+82	+43	+85	+44	22.0	53	0.88	.12							
10.5	+83	+29	+84	+30	+86	+31	+87	+32	+90	+33	22.5	54	0.92	.13							
11.0	+86	+18	+87	+19	+89	+19	+91	+20	+93	+21	23.0	55	0.95	0.14							
11.5	+87	+ 7	+89	+ 8	+91	+ 8	+93	+ 8	+95	+ 8	23.5	56	0.99	.14							
12.0	+87	- 4	+89	- 4	+91	- 4	+93	- 4	+95	- 4	24.0	57	1.03	.15							
											58	58	1.07	.16							
											59	59	1.11	.17							
TO 1960.0											TO 1961.0										
h	e	f	e	f	e	f	e	f	e	f	h	60	1.15	0.18							
0	0	+4	-2	+4	-4	+4	+5	+4	+3	+4	12	61	1.20	.19							
1	+1	+4	-1	+4	-3	+5	+6	+3	+4	+3	13	62	1.25	.20							
2	+2	+4	0	+4	-1	+6	+6	+1	+5	+2	14	63	1.31	.22							
3	+3	+3	+1	+4	0	+6	+6	-1	+5	0	15	64	1.37	.23							
4	+4	+2	+2	+3	+2	+5	+6	-2	+5	-1	16	65	1.43	0.25							
5	+4	+1	+3	+3	+3	+5	+5	-4	+4	-2	17	66	1.50	.27							
											18	67	1.57	.29							
6	+4	0	+4	+2	+4	+4	+4	-5	+4	-3	19	68	1.65	.32							
7	+4	-1	+4	+1	+5	+3	+3	-6	+4	-2	20	69	1.74	.35							
8	+4	-2	+4	0	+6	+1	+1	-6	+3	-3	21	70	1.83	0.38							
9	+3	-3	+4	-1	+6	0	-1	-6	+2	-4	22	71	1.94	.42							
10	+2	-4	+3	-2	+5	-2	-2	-6	+1	-5	23	72	2.05	.47							
11	+1	-4	+3	-3	+5	-3	-4	-5	0	-4	24	73	2.18	.52							
12	0	-4	+2	-4	+4	-4	-5	-4	-1	-4	25	74	2.32	.58							
											26	75	2.49	0.66							

FACTORS FOR COMPUTING GEOCENTRIC COORDINATES

ϕ	S	C	ϕ	S	C
± 0	0.993277	1.000000	± 45	0.994951	1.001685
1	.993278	1.000001	46	.995009	1.001744
2	.993281	1.000004	47	.995068	1.001803
3	.993286	1.000009	48	.995126	1.001862
4	.993294	1.000016	49	.995185	1.001920
5	0.993303	1.000026	50	0.995242	1.001978
6	.993314	1.000037	51	.995300	1.002036
7	.993327	1.000050	52	.995357	1.002094
8	.993342	1.000065	53	.995414	1.002151
9	.993359	1.000082	54	.995470	1.002207
10	0.993378	1.000101	55	0.995525	1.002263
11	.993399	1.000122	56	.995580	1.002318
12	.993422	1.000145	57	.995634	1.002373
13	.993446	1.000170	58	.995687	1.002426
14	.993473	1.000197	59	.995740	1.002479
15	0.993501	1.000225	60	0.995791	1.002531
16	.993531	1.000255	61	.995841	1.002581
17	.993563	1.000287	62	.995890	1.002631
18	.993596	1.000321	63	.995939	1.002679
19	.993631	1.000356	64	.995985	1.002726
20	0.993668	1.000393	65	0.996031	1.002772
21	.993706	1.000432	66	.996076	1.002817
22	.993746	1.000472	67	.996118	1.002860
23	.993787	1.000514	68	.996160	1.002902
24	.993830	1.000557	69	.996200	1.002943
25	0.993874	1.000601	70	0.996239	1.002981
26	.993920	1.000647	71	.996276	1.003019
27	.993966	1.000694	72	.996311	1.003054
28	.994014	1.000742	73	.996345	1.003088
29	.994063	1.000791	74	.996377	1.003120
30	0.994113	1.000841	75	0.996407	1.003151
31	.994164	1.000893	76	.996436	1.003180
32	.994216	1.000945	77	.996462	1.003207
33	.994269	1.000999	78	.996487	1.003232
34	.994323	1.001053	79	.996510	1.003255
35	0.994378	1.001108	80	0.996531	1.003276
36	.994433	1.001163	81	.996550	1.003295
37	.994489	1.001220	82	.996568	1.003313
38	.994545	1.001277	83	.996583	1.003328
39	.994602	1.001334	84	.996596	1.003341
40	0.994660	1.001392	85	0.996607	1.003353
41	.994717	1.001450	86	.996617	1.003362
42	.994776	1.001508	87	.996624	1.003369
43	.994834	1.001567	88	.996629	1.003374
44	.994892	1.001626	89	.996632	1.003377
± 45	0.994951	1.001685	± 90	0.996633	1.003378

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	0 00.000	0 09.830	0 19.659	0 29.489	0 39.318	0 49.148	0 58.977	1 08.807	0	0.000
1	0 00.164	0 09.993	0 19.823	0 29.653	0 39.482	0 49.312	0 59.141	1 08.971	1	.003
2	0 00.328	0 10.157	0 19.987	0 29.816	0 39.646	0 49.475	0 59.305	1 09.135	2	.005
3	0 00.491	0 10.321	0 20.151	0 29.980	0 39.810	0 49.639	0 59.469	1 09.298	3	.008
4	0 00.655	0 10.485	0 20.314	0 30.144	0 39.974	0 49.803	0 59.633	1 09.462	4	.011
5	0 00.819	0 10.649	0 20.478	0 30.308	0 40.137	0 49.967	0 59.796	1 09.626	5	0.014
6	0 00.983	0 10.813	0 20.642	0 30.472	0 40.301	0 50.131	0 59.960	1 09.790	6	.016
7	0 01.147	0 10.976	0 20.806	0 30.635	0 40.465	0 50.295	1 00.124	1 09.954	7	.019
8	0 01.311	0 11.140	0 20.970	0 30.799	0 40.629	0 50.458	1 00.288	1 10.118	8	.022
9	0 01.474	0 11.304	0 21.134	0 30.963	0 40.793	0 50.622	1 00.452	1 10.281	9	.025
10	0 01.638	0 11.468	0 21.297	0 31.127	0 40.956	0 50.786	1 00.616	1 10.445	10	0.027
11	0 01.802	0 11.632	0 21.461	0 31.291	0 41.120	0 50.950	1 00.779	1 10.609	11	.030
12	0 01.966	0 11.795	0 21.625	0 31.455	0 41.284	0 51.114	1 00.943	1 10.773	12	.033
13	0 02.130	0 11.959	0 21.789	0 31.618	0 41.448	0 51.278	1 01.107	1 10.937	13	.035
14	0 02.294	0 12.123	0 21.953	0 31.782	0 41.612	0 51.441	1 01.271	1 11.100	14	.038
15	0 02.457	0 12.287	0 22.117	0 31.946	0 41.776	0 51.605	1 01.435	1 11.264	15	0.041
16	0 02.621	0 12.451	0 22.280	0 32.110	0 41.939	0 51.769	1 01.599	1 11.428	16	.044
17	0 02.785	0 12.615	0 22.444	0 32.274	0 42.103	0 51.933	1 01.762	1 11.592	17	.046
18	0 02.949	0 12.778	0 22.608	0 32.438	0 42.267	0 52.097	1 01.926	1 11.756	18	.049
19	0 03.113	0 12.942	0 22.772	0 32.601	0 42.431	0 52.260	1 02.090	1 11.920	19	.052
20	0 03.277	0 13.106	0 22.936	0 32.765	0 42.595	0 52.424	1 02.254	1 12.083	20	0.055
21	0 03.440	0 13.270	0 23.099	0 32.929	0 42.759	0 52.588	1 02.418	1 12.247	21	.057
22	0 03.604	0 13.434	0 23.263	0 33.093	0 42.922	0 52.752	1 02.582	1 12.411	22	.060
23	0 03.768	0 13.598	0 23.427	0 33.257	0 43.086	0 52.916	1 02.745	1 12.575	23	.063
24	0 03.932	0 13.761	0 23.591	0 33.420	0 43.250	0 53.080	1 02.909	1 12.739	24	.066
25	0 04.096	0 13.925	0 23.755	0 33.584	0 43.414	0 53.243	1 03.073	1 12.903	25	0.068
26	0 04.259	0 14.089	0 23.919	0 33.748	0 43.578	0 53.407	1 03.237	1 13.066	26	.071
27	0 04.423	0 14.253	0 24.082	0 33.912	0 43.742	0 53.571	1 03.401	1 13.230	27	.074
28	0 04.587	0 14.417	0 24.246	0 34.076	0 43.905	0 53.735	1 03.564	1 13.394	28	.076
29	0 04.751	0 14.581	0 24.410	0 34.240	0 44.069	0 53.899	1 03.728	1 13.558	29	.079
30	0 04.915	0 14.744	0 24.574	0 34.403	0 44.233	0 54.063	1 03.892	1 13.722	30	0.082
31	0 05.079	0 14.908	0 24.738	0 34.567	0 44.397	0 54.226	1 04.056	1 13.886	31	.085
32	0 05.242	0 15.072	0 24.902	0 34.731	0 44.561	0 54.390	1 04.220	1 14.049	32	.087
33	0 05.406	0 15.236	0 25.065	0 34.895	0 44.724	0 54.554	1 04.384	1 14.213	33	.090
34	0 05.570	0 15.400	0 25.229	0 35.059	0 44.888	0 54.718	1 04.547	1 14.377	34	.093
35	0 05.734	0 15.563	0 25.393	0 35.223	0 45.052	0 54.882	1 04.711	1 14.541	35	0.096
36	0 05.898	0 15.727	0 25.557	0 35.386	0 45.216	0 55.046	1 04.875	1 14.705	36	.098
37	0 06.062	0 15.891	0 25.721	0 35.550	0 45.380	0 55.209	1 05.039	1 14.868	37	.101
38	0 06.225	0 16.055	0 25.885	0 35.714	0 45.544	0 55.373	1 05.203	1 15.032	38	.104
39	0 06.389	0 16.219	0 26.048	0 35.878	0 45.707	0 55.537	1 05.367	1 15.196	39	.106
40	0 06.553	0 16.383	0 26.212	0 36.042	0 45.871	0 55.701	1 05.530	1 15.360	40	0.109
41	0 06.717	0 16.546	0 26.376	0 36.206	0 46.035	0 55.865	1 05.694	1 15.524	41	.112
42	0 06.881	0 16.710	0 26.540	0 36.369	0 46.199	0 56.028	1 05.858	1 15.688	42	.115
43	0 07.045	0 16.874	0 26.704	0 36.533	0 46.363	0 56.192	1 06.022	1 15.851	43	.117
44	0 07.208	0 17.038	0 26.867	0 36.697	0 46.527	0 56.356	1 06.186	1 16.015	44	.120
45	0 07.372	0 17.202	0 27.031	0 36.861	0 46.690	0 56.520	1 06.350	1 16.179	45	0.123
46	0 07.536	0 17.366	0 27.195	0 37.025	0 46.854	0 56.684	1 06.513	1 16.343	46	.126
47	0 07.700	0 17.529	0 27.359	0 37.188	0 47.018	0 56.848	1 06.677	1 16.507	47	.128
48	0 07.864	0 17.693	0 27.523	0 37.352	0 47.182	0 57.011	1 06.841	1 16.671	48	.131
49	0 08.027	0 17.857	0 27.687	0 37.516	0 47.346	0 57.175	1 07.005	1 16.834	49	.134
50	0 08.191	0 18.021	0 27.850	0 37.680	0 47.510	0 57.339	1 07.169	1 16.998	50	0.137
51	0 08.355	0 18.185	0 28.014	0 37.844	0 47.673	0 57.503	1 07.332	1 17.162	51	.139
52	0 08.519	0 18.349	0 28.178	0 38.008	0 47.837	0 57.667	1 07.496	1 17.326	52	.142
53	0 08.683	0 18.512	0 28.342	0 38.171	0 48.001	0 57.831	1 07.660	1 17.490	53	.145
54	0 08.847	0 18.676	0 28.506	0 38.335	0 48.165	0 57.994	1 07.824	1 17.654	54	.147
55	0 09.010	0 18.840	0 28.670	0 38.499	0 48.329	0 58.158	1 07.988	1 17.817	55	0.150
56	0 09.174	0 19.004	0 28.833	0 38.663	0 48.492	0 58.322	1 08.152	1 17.981	56	.153
57	0 09.338	0 19.168	0 28.997	0 38.827	0 48.656	0 58.486	1 08.315	1 18.145	57	.156
58	0 09.502	0 19.331	0 29.161	0 38.991	0 48.820	0 58.650	1 08.479	1 18.309	58	.158
59	0 09.666	0 19.495	0 29.325	0 39.154	0 48.984	0 58.814	1 08.643	1 18.473	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h	13 ^h	14 ^h	15 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	1 18.636	1 28.466	1 38.296	1 48.125	1 57.955	2 07.784	2 17.614	2 27.443	0	0.000
1	1 18.800	1 28.630	1 38.459	1 48.289	1 58.119	2 07.948	2 17.778	2 27.607	1	.003
2	1 18.964	1 28.794	1 38.623	1 48.453	1 58.282	2 08.112	2 17.941	2 27.771	2	.005
3	1 19.128	1 28.958	1 38.787	1 48.617	1 58.446	2 08.276	2 18.105	2 27.935	3	.008
4	1 19.292	1 29.121	1 38.951	1 48.780	1 58.610	2 08.440	2 18.269	2 28.099	4	.011
5	1 19.456	1 29.285	1 39.115	1 48.944	1 58.774	2 08.603	2 18.433	2 28.263	5	0.014
6	1 19.619	1 29.449	1 39.279	1 49.108	1 58.938	2 08.767	2 18.597	2 28.426	6	.016
7	1 19.783	1 29.613	1 39.442	1 49.272	1 59.101	2 08.931	2 18.761	2 28.590	7	.019
8	1 19.947	1 29.777	1 39.606	1 49.436	1 59.265	2 09.095	2 18.924	2 28.754	8	.022
9	1 20.111	1 29.940	1 39.770	1 49.600	1 59.429	2 09.259	2 19.088	2 28.918	9	.025
10	1 20.275	1 30.104	1 39.934	1 49.763	1 59.593	2 09.423	2 19.252	2 29.082	10	0.027
11	1 20.439	1 30.268	1 40.098	1 49.927	1 59.757	2 09.586	2 19.416	2 29.245	11	.030
12	1 20.602	1 30.432	1 40.261	1 50.091	1 59.921	2 09.750	2 19.580	2 29.409	12	.033
13	1 20.766	1 30.596	1 40.425	1 50.255	2 00.084	2 09.914	2 19.744	2 29.573	13	.035
14	1 20.930	1 30.760	1 40.589	1 50.419	2 00.248	2 10.078	2 19.907	2 29.737	14	.038
15	1 21.094	1 30.923	1 40.753	1 50.583	2 00.412	2 10.242	2 20.071	2 29.901	15	0.041
16	1 21.258	1 31.087	1 40.917	1 50.746	2 00.576	2 10.405	2 20.235	2 30.065	16	.044
17	1 21.422	1 31.251	1 41.081	1 50.910	2 00.740	2 10.569	2 20.399	2 30.228	17	.046
18	1 21.585	1 31.415	1 41.244	1 51.074	2 00.904	2 10.733	2 20.563	2 30.392	18	.049
19	1 21.749	1 31.579	1 41.408	1 51.238	2 01.067	2 10.897	2 20.727	2 30.556	19	.052
20	1 21.913	1 31.743	1 41.572	1 51.402	2 01.231	2 11.061	2 20.890	2 30.720	20	0.055
21	1 22.077	1 31.906	1 41.736	1 51.565	2 01.395	2 11.225	2 21.054	2 30.884	21	.057
22	1 22.241	1 32.070	1 41.900	1 51.729	2 01.559	2 11.388	2 21.218	2 31.048	22	.060
23	1 22.404	1 32.234	1 42.064	1 51.893	2 01.723	2 11.552	2 21.382	2 31.211	23	.063
24	1 22.568	1 32.398	1 42.227	1 52.057	2 01.887	2 11.716	2 21.546	2 31.375	24	.066
25	1 22.732	1 32.562	1 42.391	1 52.221	2 02.050	2 11.880	2 21.709	2 31.539	25	0.068
26	1 22.896	1 32.726	1 42.555	1 52.385	2 02.214	2 12.044	2 21.873	2 31.703	26	.071
27	1 23.060	1 32.889	1 42.719	1 52.548	2 02.378	2 12.208	2 22.037	2 31.867	27	.074
28	1 23.224	1 33.053	1 42.883	1 52.712	2 02.542	2 12.371	2 22.201	2 32.031	28	.076
29	1 23.387	1 33.217	1 43.047	1 52.876	2 02.706	2 12.535	2 22.365	2 32.194	29	.079
30	1 23.551	1 33.381	1 43.210	1 53.040	2 02.869	2 12.699	2 22.529	2 32.358	30	0.082
31	1 23.715	1 33.545	1 43.374	1 53.204	2 03.033	2 12.863	2 22.692	2 32.522	31	.085
32	1 23.879	1 33.708	1 43.538	1 53.368	2 03.197	2 13.027	2 22.856	2 32.686	32	.087
33	1 24.043	1 33.872	1 43.702	1 53.531	2 03.361	2 13.191	2 23.020	2 32.850	33	.090
34	1 24.207	1 34.036	1 43.866	1 53.695	2 03.525	2 13.354	2 23.184	2 33.013	34	.093
35	1 24.370	1 34.200	1 44.029	1 53.859	2 03.689	2 13.518	2 23.348	2 33.177	35	0.096
36	1 24.534	1 34.364	1 44.193	1 54.023	2 03.852	2 13.682	2 23.512	2 33.341	36	.098
37	1 24.698	1 34.528	1 44.357	1 54.187	2 04.016	2 13.846	2 23.675	2 33.505	37	.101
38	1 24.862	1 34.691	1 44.521	1 54.351	2 04.180	2 14.010	2 23.839	2 33.669	38	.104
39	1 25.026	1 34.855	1 44.685	1 54.514	2 04.344	2 14.173	2 24.003	2 33.833	39	.106
40	1 25.190	1 35.019	1 44.849	1 54.678	2 04.508	2 14.337	2 24.167	2 33.996	40	0.109
41	1 25.353	1 35.183	1 45.012	1 54.842	2 04.672	2 14.501	2 24.331	2 34.160	41	.112
42	1 25.517	1 35.347	1 45.176	1 55.006	2 04.835	2 14.665	2 24.495	2 34.324	42	.115
43	1 25.681	1 35.511	1 45.340	1 55.170	2 04.999	2 14.829	2 24.658	2 34.488	43	.117
44	1 25.845	1 35.674	1 45.504	1 55.333	2 05.163	2 14.993	2 24.822	2 34.652	44	.120
45	1 26.009	1 35.838	1 45.668	1 55.497	2 05.327	2 15.156	2 24.986	2 34.816	45	0.123
46	1 26.172	1 36.002	1 45.832	1 55.661	2 05.491	2 15.320	2 25.150	2 34.979	46	.126
47	1 26.336	1 36.166	1 45.995	1 55.825	2 05.655	2 15.484	2 25.314	2 35.143	47	.128
48	1 26.500	1 36.330	1 46.159	1 55.989	2 05.818	2 15.648	2 25.477	2 35.307	48	.131
49	1 26.664	1 36.493	1 46.323	1 56.153	2 05.982	2 15.812	2 25.641	2 35.471	49	.134
50	1 26.828	1 36.657	1 46.487	1 56.316	2 06.146	2 15.976	2 25.805	2 35.635	50	0.137
51	1 26.992	1 36.821	1 46.651	1 56.480	2 06.310	2 16.139	2 25.969	2 35.798	51	.139
52	1 27.155	1 36.985	1 46.815	1 56.644	2 06.474	2 16.303	2 26.133	2 35.962	52	.142
53	1 27.319	1 37.149	1 46.978	1 56.808	2 06.637	2 16.467	2 26.297	2 36.126	53	.145
54	1 27.483	1 37.313	1 47.142	1 56.972	2 06.801	2 16.631	2 26.460	2 36.290	54	.147
55	1 27.647	1 37.476	1 47.306	1 57.136	2 06.965	2 16.795	2 26.624	2 36.454	55	0.150
56	1 27.811	1 37.640	1 47.470	1 57.299	2 07.129	2 16.959	2 26.788	2 36.618	56	.153
57	1 27.975	1 37.804	1 47.634	1 57.463	2 07.293	2 17.122	2 26.952	2 36.781	57	.156
58	1 28.138	1 37.968	1 47.797	1 57.627	2 07.457	2 17.286	2 27.116	2 36.945	58	.158
59	1 28.302	1 38.132	1 47.961	1 57.791	2 07.620	2 17.450	2 27.280	2 37.109	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	2 37.273	2 47.102	2 56.932	3 06.762	3 16.591	3 26.421	3 36.250	3 46.080	0	0.000
1	2 37.437	2 47.266	2 57.096	3 06.925	3 16.755	3 26.585	3 36.414	3 46.244	1	.003
2	2 37.601	2 47.430	2 57.260	3 07.089	3 16.919	3 26.748	3 36.578	3 46.407	2	.005
3	2 37.764	2 47.594	2 57.424	3 07.253	3 17.083	3 26.912	3 36.742	3 46.571	3	.008
4	2 37.928	2 47.758	2 57.587	3 07.417	3 17.246	3 27.076	3 36.906	3 46.735	4	.011
5	2 38.092	2 47.922	2 57.751	3 07.581	3 17.410	3 27.240	3 37.069	3 46.899	5	0.014
6	2 38.256	2 48.085	2 57.915	3 07.745	3 17.574	3 27.404	3 37.233	3 47.063	6	.016
7	2 38.420	2 48.249	2 58.079	3 07.908	3 17.738	3 27.568	3 37.397	3 47.227	7	.019
8	2 38.584	2 48.413	2 58.243	3 08.072	3 17.902	3 27.731	3 37.561	3 47.390	8	.022
9	2 38.747	2 48.577	2 58.406	3 08.236	3 18.066	3 27.895	3 37.725	3 47.554	9	.025
10	2 38.911	2 48.741	2 58.570	3 08.400	3 18.229	3 28.059	3 37.889	3 47.718	10	0.027
11	2 39.075	2 48.905	2 58.734	3 08.564	3 18.393	3 28.223	3 38.052	3 47.882	11	.030
12	2 39.239	2 49.068	2 58.898	3 08.728	3 18.557	3 28.387	3 38.216	3 48.046	12	.033
13	2 39.403	2 49.232	2 59.062	3 08.891	3 18.721	3 28.550	3 38.380	3 48.210	13	.035
14	2 39.566	2 49.396	2 59.226	3 09.055	3 18.885	3 28.714	3 38.544	3 48.373	14	.038
15	2 39.730	2 49.560	2 59.389	3 09.219	3 19.049	3 28.878	3 38.708	3 48.537	15	0.041
16	2 39.894	2 49.724	2 59.553	3 09.383	3 19.212	3 29.042	3 38.871	3 48.701	16	.044
17	2 40.058	2 49.888	2 59.717	3 09.547	3 19.376	3 29.206	3 39.035	3 48.865	17	.046
18	2 40.222	2 50.051	2 59.881	3 09.710	3 19.540	3 29.370	3 39.199	3 49.029	18	.049
19	2 40.386	2 50.215	3 00.045	3 09.874	3 19.704	3 29.533	3 39.363	3 49.193	19	.052
20	2 40.549	2 50.379	3 00.209	3 10.038	3 19.868	3 29.697	3 39.527	3 49.356	20	0.055
21	2 40.713	2 50.543	3 00.372	3 10.202	3 20.032	3 29.861	3 39.691	3 49.520	21	.057
22	2 40.877	2 50.707	3 00.536	3 10.366	3 20.195	3 30.025	3 39.854	3 49.684	22	.060
23	2 41.041	2 50.870	3 00.700	3 10.530	3 20.359	3 30.189	3 40.018	3 49.848	23	.063
24	2 41.205	2 51.034	3 00.864	3 10.693	3 20.523	3 30.353	3 40.182	3 50.012	24	.066
25	2 41.369	2 51.198	3 01.028	3 10.857	3 20.687	3 30.516	3 40.346	3 50.175	25	0.068
26	2 41.532	2 51.362	3 01.192	3 11.021	3 20.851	3 30.680	3 40.510	3 50.339	26	.071
27	2 41.696	2 51.526	3 01.355	3 11.185	3 21.014	3 30.844	3 40.674	3 50.503	27	.074
28	2 41.860	2 51.690	3 01.519	3 11.349	3 21.178	3 31.008	3 40.837	3 50.667	28	.076
29	2 42.024	2 51.853	3 01.683	3 11.513	3 21.342	3 31.172	3 41.001	3 50.831	29	.079
30	2 42.188	2 52.017	3 01.847	3 11.676	3 21.506	3 31.336	3 41.165	3 50.995	30	0.082
31	2 42.352	2 52.181	3 02.011	3 11.840	3 21.670	3 31.499	3 41.329	3 51.158	31	.085
32	2 42.515	2 52.345	3 02.174	3 12.004	3 21.834	3 31.663	3 41.493	3 51.322	32	.087
33	2 42.679	2 52.509	3 02.338	3 12.168	3 21.997	3 31.827	3 41.657	3 51.486	33	.090
34	2 42.843	2 52.673	3 02.502	3 12.332	3 22.161	3 31.991	3 41.820	3 51.650	34	.093
35	2 43.007	2 52.836	3 02.666	3 12.496	3 22.325	3 32.155	3 41.984	3 51.814	35	0.096
36	2 43.171	2 53.000	3 02.830	3 12.659	3 22.489	3 32.318	3 42.148	3 51.978	36	.098
37	2 43.334	2 53.164	3 02.994	3 12.823	3 22.653	3 32.482	3 42.312	3 52.141	37	.101
38	2 43.498	2 53.328	3 03.157	3 12.987	3 22.817	3 32.646	3 42.476	3 52.305	38	.104
39	2 43.662	2 53.492	3 03.321	3 13.151	3 22.980	3 32.810	3 42.639	3 52.469	39	.106
40	2 43.826	2 53.656	3 03.485	3 13.315	3 23.144	3 32.974	3 42.803	3 52.633	40	0.109
41	2 43.990	2 53.819	3 03.649	3 13.478	3 23.308	3 33.138	3 42.967	3 52.797	41	.112
42	2 44.154	2 53.983	3 03.813	3 13.642	3 23.472	3 33.301	3 43.131	3 52.961	42	.115
43	2 44.317	2 54.147	3 03.977	3 13.806	3 23.636	3 33.465	3 43.295	3 53.124	43	.117
44	2 44.481	2 54.311	3 04.140	3 13.970	3 23.800	3 33.629	3 43.459	3 53.288	44	.120
45	2 44.645	2 54.475	3 04.304	3 14.134	3 23.963	3 33.793	3 43.622	3 53.452	45	0.123
46	2 44.809	2 54.638	3 04.468	3 14.298	3 24.127	3 33.957	3 43.786	3 53.616	46	.126
47	2 44.973	2 54.802	3 04.632	3 14.461	3 24.291	3 34.121	3 43.950	3 53.780	47	.128
48	2 45.137	2 54.966	3 04.796	3 14.625	3 24.455	3 34.284	3 44.114	3 53.943	48	.131
49	2 45.300	2 55.130	3 04.960	3 14.789	3 24.619	3 34.448	3 44.278	3 54.107	49	.134
50	2 45.464	2 55.294	3 05.123	3 14.953	3 24.782	3 34.612	3 44.442	3 54.271	50	0.137
51	2 45.628	2 55.458	3 05.287	3 15.117	3 24.946	3 34.776	3 44.605	3 54.435	51	.139
52	2 45.792	2 55.621	3 05.451	3 15.281	3 25.110	3 34.940	3 44.769	3 54.599	52	.142
53	2 45.956	2 55.785	3 05.615	3 15.444	3 25.274	3 35.104	3 44.933	3 54.763	53	.145
54	2 46.120	2 55.949	3 05.779	3 15.608	3 25.438	3 35.267	3 45.097	3 54.926	54	.147
55	2 46.283	2 56.113	3 05.942	3 15.772	3 25.602	3 35.431	3 45.261	3 55.090	55	0.150
56	2 46.447	2 56.277	3 06.106	3 15.936	3 25.765	3 35.595	3 45.425	3 55.254	56	.153
57	2 46.611	2 56.441	3 06.270	3 16.100	3 25.929	3 35.759	3 45.588	3 55.418	57	.156
58	2 46.775	2 56.604	3 06.434	3 16.264	3 26.093	3 35.923	3 45.752	3 55.582	58	.158
59	2 46.939	2 56.768	3 06.598	3 16.427	3 26.257	3 36.086	3 45.916	3 55.746	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	0 00.000	0 09.856	0 19.713	0 29.569	0 39.426	0 49.282	0 59.139	1 08.995	0	0.000
1	0 00.164	0 10.021	0 19.877	0 29.734	0 39.590	0 49.447	0 59.303	1 09.160	1	.003
2	0 00.329	0 10.185	0 20.041	0 29.898	0 39.754	0 49.611	0 59.467	1 09.324	2	.005
3	0 00.493	0 10.349	0 20.206	0 30.062	0 39.919	0 49.775	0 59.632	1 09.488	3	.008
4	0 00.657	0 10.514	0 20.370	0 30.227	0 40.083	0 49.939	0 59.796	1 09.652	4	.011
5	0 00.821	0 10.678	0 20.534	0 30.391	0 40.247	0 50.104	0 59.960	1 09.817	5	0.014
6	0 00.986	0 10.842	0 20.699	0 30.555	0 40.412	0 50.268	1 00.124	1 09.981	6	.016
7	0 01.150	0 11.006	0 20.863	0 30.719	0 40.576	0 50.432	1 00.289	1 10.145	7	.019
8	0 01.314	0 11.171	0 21.027	0 30.884	0 40.740	0 50.597	1 00.453	1 10.310	8	.022
9	0 01.478	0 11.335	0 21.191	0 31.048	0 40.904	0 50.761	1 00.617	1 10.474	9	.025
10	0 01.643	0 11.499	0 21.356	0 31.212	0 41.069	0 50.925	1 00.782	1 10.638	10	0.027
11	0 01.807	0 11.663	0 21.520	0 31.376	0 41.233	0 51.089	1 00.946	1 10.802	11	.030
12	0 01.971	0 11.828	0 21.684	0 31.541	0 41.397	0 51.254	1 01.110	1 10.967	12	.033
13	0 02.136	0 11.992	0 21.849	0 31.705	0 41.561	0 51.418	1 01.274	1 11.131	13	.036
14	0 02.300	0 12.156	0 22.013	0 31.869	0 41.726	0 51.582	1 01.439	1 11.295	14	.038
15	0 02.464	0 12.321	0 22.177	0 32.034	0 41.890	0 51.746	1 01.603	1 11.459	15	0.041
16	0 02.628	0 12.485	0 22.341	0 32.198	0 42.054	0 51.911	1 01.767	1 11.624	16	.044
17	0 02.793	0 12.649	0 22.506	0 32.362	0 42.219	0 52.075	1 01.932	1 11.788	17	.047
18	0 02.957	0 12.813	0 22.670	0 32.526	0 42.383	0 52.239	1 02.096	1 11.952	18	.049
19	0 03.121	0 12.978	0 22.834	0 32.691	0 42.547	0 52.404	1 02.260	1 12.117	19	.052
20	0 03.285	0 13.142	0 22.998	0 32.855	0 42.711	0 52.568	1 02.424	1 12.281	20	0.055
21	0 03.450	0 13.306	0 23.163	0 33.019	0 42.876	0 52.732	1 02.589	1 12.445	21	.057
22	0 03.614	0 13.471	0 23.327	0 33.183	0 43.040	0 52.896	1 02.753	1 12.609	22	.060
23	0 03.778	0 13.635	0 23.491	0 33.348	0 43.204	0 53.061	1 02.917	1 12.774	23	.063
24	0 03.943	0 13.799	0 23.656	0 33.512	0 43.368	0 53.225	1 03.081	1 12.938	24	.066
25	0 04.107	0 13.963	0 23.820	0 33.676	0 43.533	0 53.389	1 03.246	1 13.102	25	0.068
26	0 04.271	0 14.128	0 23.984	0 33.841	0 43.697	0 53.554	1 03.410	1 13.266	26	.071
27	0 04.435	0 14.292	0 24.148	0 34.005	0 43.861	0 53.718	1 03.574	1 13.431	27	.074
28	0 04.600	0 14.456	0 24.313	0 34.169	0 44.026	0 53.882	1 03.739	1 13.595	28	.077
29	0 04.764	0 14.620	0 24.477	0 34.333	0 44.190	0 54.046	1 03.903	1 13.759	29	.079
30	0 04.928	0 14.785	0 24.641	0 34.498	0 44.354	0 54.211	1 04.067	1 13.924	30	0.082
31	0 05.093	0 14.949	0 24.805	0 34.662	0 44.518	0 54.375	1 04.231	1 14.088	31	.085
32	0 05.257	0 15.113	0 24.970	0 34.826	0 44.683	0 54.539	1 04.396	1 14.252	32	.088
33	0 05.421	0 15.278	0 25.134	0 34.990	0 44.847	0 54.703	1 04.560	1 14.416	33	.090
34	0 05.585	0 15.442	0 25.298	0 35.155	0 45.011	0 54.868	1 04.724	1 14.581	34	.093
35	0 05.750	0 15.606	0 25.463	0 35.319	0 45.176	0 55.032	1 04.888	1 14.745	35	0.096
36	0 05.914	0 15.770	0 25.627	0 35.483	0 45.340	0 55.196	1 05.053	1 14.909	36	.099
37	0 06.078	0 15.935	0 25.791	0 35.648	0 45.504	0 55.361	1 05.217	1 15.073	37	.101
38	0 06.242	0 16.099	0 25.955	0 35.812	0 45.668	0 55.525	1 05.381	1 15.238	38	.104
39	0 06.407	0 16.263	0 26.120	0 35.976	0 45.833	0 55.689	1 05.546	1 15.402	39	.107
40	0 06.571	0 16.427	0 26.284	0 36.140	0 45.997	0 55.853	1 05.710	1 15.566	40	0.110
41	0 06.735	0 16.592	0 26.448	0 36.305	0 46.161	0 56.018	1 05.874	1 15.731	41	.112
42	0 06.900	0 16.756	0 26.612	0 36.469	0 46.325	0 56.182	1 06.038	1 15.895	42	.115
43	0 07.064	0 16.920	0 26.777	0 36.633	0 46.490	0 56.346	1 06.203	1 16.059	43	.118
44	0 07.228	0 17.085	0 26.941	0 36.798	0 46.654	0 56.510	1 06.367	1 16.223	44	.120
45	0 07.392	0 17.249	0 27.105	0 36.962	0 46.818	0 56.675	1 06.531	1 16.388	45	0.123
46	0 07.557	0 17.413	0 27.270	0 37.126	0 46.983	0 56.839	1 06.695	1 16.552	46	.126
47	0 07.721	0 17.577	0 27.434	0 37.290	0 47.147	0 57.003	1 06.860	1 16.716	47	.129
48	0 07.885	0 17.742	0 27.598	0 37.455	0 47.311	0 57.168	1 07.024	1 16.881	48	.131
49	0 08.049	0 17.906	0 27.762	0 37.619	0 47.475	0 57.332	1 07.188	1 17.045	49	.134
50	0 08.214	0 18.070	0 27.927	0 37.783	0 47.640	0 57.496	1 07.353	1 17.209	50	0.137
51	0 08.378	0 18.234	0 28.091	0 37.947	0 47.804	0 57.660	1 07.517	1 17.373	51	.140
52	0 08.542	0 18.399	0 28.255	0 38.112	0 47.968	0 57.825	1 07.681	1 17.538	52	.142
53	0 08.707	0 18.563	0 28.420	0 38.276	0 48.132	0 57.989	1 07.845	1 17.702	53	.145
54	0 08.871	0 18.727	0 28.584	0 38.440	0 48.297	0 58.153	1 08.010	1 17.866	54	.148
55	0 09.035	0 18.892	0 28.748	0 38.605	0 48.461	0 58.317	1 08.174	1 18.030	55	0.151
56	0 09.199	0 19.056	0 28.912	0 38.769	0 48.625	0 58.482	1 08.338	1 18.195	56	.153
57	0 09.364	0 19.220	0 29.077	0 38.933	0 48.790	0 58.646	1 08.502	1 18.359	57	.156
58	0 09.528	0 19.384	0 29.241	0 39.097	0 48.954	0 58.810	1 08.667	1 18.523	58	.159
59	0 09.692	0 19.549	0 29.405	0 39.262	0 49.118	0 58.975	1 08.831	1 18.688	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

m	8 ^b		9 ^b		10 ^b		11 ^b		12 ^b		13 ^b		14 ^b		15 ^b		SECONDS	
	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	1	18.852	1	28.708	1	38.565	1	48.421	1	58.278	2	08.134	2	17.991	2	27.847	0	0.000
1	1	19.016	1	28.873	1	38.729	1	48.585	1	58.442	2	08.298	2	18.155	2	28.011	1	.003
2	1	19.180	1	29.037	1	38.893	1	48.750	1	58.606	2	08.463	2	18.319	2	28.176	2	.005
3	1	19.345	1	29.201	1	39.058	1	48.914	1	58.771	2	08.627	2	18.483	2	28.340	3	.008
4	1	19.509	1	29.365	1	39.222	1	49.078	1	58.935	2	08.791	2	18.648	2	28.504	4	.011
5	1	19.673	1	29.530	1	39.386	1	49.243	1	59.099	2	08.956	2	18.812	2	28.668	5	0.014
6	1	19.837	1	29.694	1	39.550	1	49.407	1	59.263	2	09.120	2	18.976	2	28.833	6	.016
7	1	20.002	1	29.858	1	39.715	1	49.571	1	59.428	2	09.284	2	19.141	2	28.997	7	.019
8	1	20.166	1	30.022	1	39.879	1	49.735	1	59.592	2	09.448	2	19.305	2	29.161	8	.022
9	1	20.330	1	30.187	1	40.043	1	49.900	1	59.756	2	09.613	2	19.469	2	29.326	9	.025
10	1	20.495	1	30.351	1	40.207	1	50.064	1	59.920	2	09.777	2	19.633	2	29.490	10	0.027
11	1	20.659	1	30.515	1	40.372	1	50.228	2	00.085	2	09.941	2	19.798	2	29.654	11	.030
12	1	20.823	1	30.680	1	40.536	1	50.393	2	00.249	2	10.105	2	19.962	2	29.818	12	.033
13	1	20.987	1	30.844	1	40.700	1	50.557	2	00.413	2	10.270	2	20.126	2	29.983	13	.036
14	1	21.152	1	31.008	1	40.865	1	50.721	2	00.578	2	10.434	2	20.290	2	30.147	14	.038
15	1	21.316	1	31.172	1	41.029	1	50.885	2	00.742	2	10.598	2	20.455	2	30.311	15	0.041
16	1	21.480	1	31.337	1	41.193	1	51.050	2	00.906	2	10.763	2	20.619	2	30.476	16	.044
17	1	21.644	1	31.501	1	41.357	1	51.214	2	01.070	2	10.927	2	20.783	2	30.640	17	.047
18	1	21.809	1	31.665	1	41.522	1	51.378	2	01.235	2	11.091	2	20.948	2	30.804	18	.049
19	1	21.973	1	31.829	1	41.686	1	51.542	2	01.399	2	11.255	2	21.112	2	30.968	19	.052
20	1	22.137	1	31.994	1	41.850	1	51.707	2	01.563	2	11.420	2	21.276	2	31.133	20	0.055
21	1	22.302	1	32.158	1	42.015	1	51.871	2	01.727	2	11.584	2	21.440	2	31.297	21	.057
22	1	22.466	1	32.322	1	42.179	1	52.035	2	01.892	2	11.748	2	21.605	2	31.461	22	.060
23	1	22.630	1	32.487	1	42.343	1	52.200	2	02.056	2	11.912	2	21.769	2	31.625	23	.063
24	1	22.794	1	32.651	1	42.507	1	52.364	2	02.220	2	12.077	2	21.933	2	31.790	24	.066
25	1	22.959	1	32.815	1	42.672	1	52.528	2	02.385	2	12.241	2	22.098	2	31.954	25	0.068
26	1	23.123	1	32.979	1	42.836	1	52.692	2	02.549	2	12.405	2	22.262	2	32.118	26	.071
27	1	23.287	1	33.144	1	43.000	1	52.857	2	02.713	2	12.570	2	22.426	2	32.283	27	.074
28	1	23.451	1	33.308	1	43.164	1	53.021	2	02.877	2	12.734	2	22.590	2	32.447	28	.077
29	1	23.616	1	33.472	1	43.329	1	53.185	2	03.042	2	12.898	2	22.755	2	32.611	29	.079
30	1	23.780	1	33.637	1	43.493	1	53.349	2	03.206	2	13.062	2	22.919	2	32.775	30	0.082
31	1	23.944	1	33.801	1	43.657	1	53.514	2	03.370	2	13.227	2	23.083	2	32.940	31	.085
32	1	24.109	1	33.965	1	43.822	1	53.678	2	03.534	2	13.391	2	23.247	2	33.104	32	.088
33	1	24.273	1	34.129	1	43.986	1	53.842	2	03.699	2	13.555	2	23.412	2	33.268	33	.090
34	1	24.437	1	34.294	1	44.150	1	54.007	2	03.863	2	13.720	2	23.576	2	33.432	34	.093
35	1	24.601	1	34.458	1	44.314	1	54.171	2	04.027	2	13.884	2	23.740	2	33.597	35	0.096
36	1	24.766	1	34.622	1	44.479	1	54.335	2	04.192	2	14.048	2	23.905	2	33.761	36	.099
37	1	24.930	1	34.786	1	44.643	1	54.499	2	04.356	2	14.212	2	24.069	2	33.925	37	.101
38	1	25.094	1	34.951	1	44.807	1	54.664	2	04.520	2	14.377	2	24.233	2	34.090	38	.104
39	1	25.259	1	35.115	1	44.971	1	54.828	2	04.684	2	14.541	2	24.397	2	34.254	39	.107
40	1	25.423	1	35.279	1	45.136	1	54.992	2	04.849	2	14.705	2	24.562	2	34.418	40	0.110
41	1	25.587	1	35.444	1	45.300	1	55.156	2	05.013	2	14.869	2	24.726	2	34.582	41	.112
42	1	25.751	1	35.608	1	45.464	1	55.321	2	05.177	2	15.034	2	24.890	2	34.747	42	.115
43	1	25.916	1	35.772	1	45.629	1	55.485	2	05.342	2	15.198	2	25.054	2	34.911	43	.118
44	1	26.080	1	35.936	1	45.793	1	55.649	2	05.506	2	15.362	2	25.219	2	35.075	44	.120
45	1	26.244	1	36.101	1	45.957	1	55.814	2	05.670	2	15.527	2	25.383	2	35.239	45	0.123
46	1	26.408	1	36.265	1	46.121	1	55.978	2	05.834	2	15.691	2	25.547	2	35.404	46	.126
47	1	26.573	1	36.429	1	46.286	1	56.142	2	05.999	2	15.855	2	25.712	2	35.568	47	.129
48	1	26.737	1	36.593	1	46.450	1	56.306	2	06.163	2	16.019	2	25.876	2	35.732	48	.131
49	1	26.901	1	36.758	1	46.614	1	56.471	2	06.327	2	16.184	2	26.040	2	35.897	49	.134
50	1	27.066	1	36.922	1	46.778	1	56.635	2	06.491	2	16.348	2	26.204	2	36.061	50	0.137
51	1	27.230	1	37.086	1	46.943	1	56.799	2	06.656	2	16.512	2	26.369	2	36.225	51	.140
52	1	27.394	1	37.251	1	47.107	1	56.964	2	06.820	2	16.676	2	26.533	2	36.389	52	.142
53	1	27.558	1	37.415	1	47.271	1	57.128	2	06.984	2	16.841	2	26.697	2	36.554	53	.145
54	1	27.723	1	37.579	1	47.436	1	57.292	2	07.149	2	17.005	2	26.861	2	36.718	54	.148
55	1	27.887	1	37.743	1	47.600	1	57.456	2	07.313	2	17.169	2	27.026	2	36.882	55	0.151
56	1	28.051	1	37.908	1	47.764	1	57.621	2	07.477	2	17.334	2	27.190	2	37.047	56	.153
57	1	28.215	1	38.072	1	47.928	1	57.785	2	07.641	2	17.498	2	27.354	2	37.211	57	.156
58	1	28.380	1	38.236	1	48.093	1	57.949	2	07.806	2	17.662	2	27.519	2	37.375	58	.159
59	1	28.544	1	38.400	1	48.257	1	58.113	2	07.970	2	17.826	2	27.683	2	37.539	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	2 37.704	2 47.560	2 57.417	3 07.273	3 17.129	3 26.986	3 36.842	3 46.699	0	0.000
1	2 37.868	2 47.724	2 57.581	3 07.437	3 17.294	3 27.150	3 37.007	3 46.863	1	.003
2	2 38.032	2 47.889	2 57.745	3 07.602	3 17.458	3 27.315	3 37.171	3 47.027	2	.005
3	2 38.196	2 48.053	2 57.909	3 07.766	3 17.622	3 27.479	3 37.335	3 47.192	3	.008
4	2 38.361	2 48.217	2 58.074	3 07.930	3 17.787	3 27.643	3 37.500	3 47.356	4	.011
5	2 38.525	2 48.381	2 58.238	3 08.094	3 17.951	3 27.807	3 37.664	3 47.520	5	0.014
6	2 38.689	2 48.546	2 58.402	3 08.259	3 18.115	3 27.972	3 37.828	3 47.685	6	.016
7	2 38.854	2 48.710	2 58.566	3 08.423	3 18.279	3 28.136	3 37.992	3 47.849	7	.019
8	2 39.018	2 48.874	2 58.731	3 08.587	3 18.444	3 28.300	3 38.157	3 48.013	8	.022
9	2 39.182	2 49.039	2 58.895	3 08.751	3 18.608	3 28.464	3 38.321	3 48.177	9	.025
10	2 39.346	2 49.203	2 59.059	3 08.916	3 18.772	3 28.629	3 38.485	3 48.342	10	0.027
11	2 39.511	2 49.367	2 59.224	3 09.080	3 18.937	3 28.793	3 38.649	3 48.506	11	.030
12	2 39.675	2 49.531	2 59.388	3 09.244	3 19.101	3 28.957	3 38.814	3 48.670	12	.033
13	2 39.839	2 49.696	2 59.552	3 09.409	3 19.265	3 29.122	3 38.978	3 48.834	13	.036
14	2 40.003	2 49.860	2 59.716	3 09.573	3 19.429	3 29.286	3 39.142	3 48.999	14	.038
15	2 40.168	2 50.024	2 59.881	3 09.737	3 19.594	3 29.450	3 39.307	3 49.163	15	0.041
16	2 40.332	2 50.188	3 00.045	3 09.901	3 19.758	3 29.614	3 39.471	3 49.327	16	.044
17	2 40.496	2 50.353	3 00.209	3 10.066	3 19.922	3 29.779	3 39.635	3 49.492	17	.047
18	2 40.661	2 50.517	3 00.373	3 10.230	3 20.086	3 29.943	3 39.799	3 49.656	18	.049
19	2 40.825	2 50.681	3 00.538	3 10.394	3 20.251	3 30.107	3 39.964	3 49.820	19	.052
20	2 40.989	2 50.846	3 00.702	3 10.559	3 20.415	3 30.271	3 40.128	3 49.984	20	0.055
21	2 41.153	2 51.010	3 00.866	3 10.723	3 20.579	3 30.436	3 40.292	3 50.149	21	.057
22	2 41.318	2 51.174	3 01.031	3 10.887	3 20.744	3 30.600	3 40.456	3 50.313	22	.060
23	2 41.482	2 51.338	3 01.195	3 11.051	3 20.908	3 30.764	3 40.621	3 50.477	23	.063
24	2 41.646	2 51.503	3 01.359	3 11.216	3 21.072	3 30.929	3 40.785	3 50.642	24	.066
25	2 41.810	2 51.667	3 01.523	3 11.380	3 21.236	3 31.093	3 40.949	3 50.806	25	0.068
26	2 41.975	2 51.831	3 01.688	3 11.544	3 21.401	3 31.257	3 41.114	3 50.970	26	.071
27	2 42.139	2 51.995	3 01.852	3 11.708	3 21.565	3 31.421	3 41.278	3 51.134	27	.074
28	2 42.303	2 52.160	3 02.016	3 11.873	3 21.729	3 31.586	3 41.442	3 51.299	28	.077
29	2 42.468	2 52.324	3 02.181	3 12.037	3 21.893	3 31.750	3 41.606	3 51.463	29	.079
30	2 42.632	2 52.488	3 02.345	3 12.201	3 22.058	3 31.914	3 41.771	3 51.627	30	0.082
31	2 42.796	2 52.653	3 02.509	3 12.366	3 22.222	3 32.078	3 41.935	3 51.791	31	.085
32	2 42.960	2 52.817	3 02.673	3 12.530	3 22.386	3 32.243	3 42.099	3 51.956	32	.088
33	2 43.125	2 52.981	3 02.838	3 12.694	3 22.551	3 32.407	3 42.264	3 52.120	33	.090
34	2 43.289	2 53.145	3 03.002	3 12.858	3 22.715	3 32.571	3 42.428	3 52.284	34	.093
35	2 43.453	2 53.310	3 03.166	3 13.023	3 22.879	3 32.736	3 42.592	3 52.449	35	0.096
36	2 43.617	2 53.474	3 03.330	3 13.187	3 23.043	3 32.900	3 42.756	3 52.613	36	.099
37	2 43.782	2 53.638	3 03.495	3 13.351	3 23.208	3 33.064	3 42.921	3 52.777	37	.101
38	2 43.946	2 53.803	3 03.659	3 13.515	3 23.372	3 33.228	3 43.085	3 52.941	38	.104
39	2 44.110	2 53.967	3 03.823	3 13.680	3 23.536	3 33.393	3 43.249	3 53.106	39	.107
40	2 44.275	2 54.131	3 03.988	3 13.844	3 23.700	3 33.557	3 43.413	3 53.270	40	0.110
41	2 44.439	2 54.295	3 04.152	3 14.008	3 23.865	3 33.721	3 43.578	3 53.434	41	.112
42	2 44.603	2 54.460	3 04.316	3 14.173	3 24.029	3 33.886	3 43.742	3 53.598	42	.115
43	2 44.767	2 54.624	3 04.480	3 14.337	3 24.193	3 34.050	3 43.906	3 53.763	43	.118
44	2 44.932	2 54.788	3 04.645	3 14.501	3 24.358	3 34.214	3 44.071	3 53.927	44	.120
45	2 45.096	2 54.952	3 04.809	3 14.665	3 24.522	3 34.378	3 44.235	3 54.091	45	0.123
46	2 45.260	2 55.117	3 04.973	3 14.830	3 24.686	3 34.543	3 44.399	3 54.256	46	.126
47	2 45.425	2 55.281	3 05.137	3 14.994	3 24.850	3 34.707	3 44.563	3 54.420	47	.129
48	2 45.589	2 55.445	3 05.302	3 15.158	3 25.015	3 34.871	3 44.728	3 54.584	48	.131
49	2 45.753	2 55.610	3 05.466	3 15.322	3 25.179	3 35.035	3 44.892	3 54.748	49	.134
50	2 45.917	2 55.774	3 05.630	3 15.487	3 25.343	3 35.200	3 45.056	3 54.913	50	0.137
51	2 46.082	2 55.938	3 05.795	3 15.651	3 25.508	3 35.364	3 45.220	3 55.077	51	.140
52	2 46.246	2 56.102	3 05.959	3 15.815	3 25.672	3 35.528	3 45.385	3 55.241	52	.142
53	2 46.410	2 56.267	3 06.123	3 15.980	3 25.836	3 35.693	3 45.549	3 55.405	53	.145
54	2 46.574	2 56.431	3 06.287	3 16.144	3 26.000	3 35.857	3 45.713	3 55.570	54	.148
55	2 46.739	2 56.595	3 06.452	3 16.308	3 26.165	3 36.021	3 45.878	3 55.734	55	0.151
56	2 46.903	2 56.759	3 06.616	3 16.472	3 26.329	3 36.185	3 46.042	3 55.898	56	.153
57	2 47.067	2 56.924	3 06.780	3 16.637	3 26.493	3 36.350	3 46.206	3 56.063	57	.156
58	2 47.232	2 57.088	3 06.944	3 16.801	3 26.657	3 36.514	3 46.370	3 56.227	58	.159
59	2 47.396	2 57.252	3 07.109	3 16.965	3 26.822	3 36.678	3 46.535	3 56.391	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF HOURS, MINUTES, AND SECONDS TO DECIMALS OF A DAY

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	SECONDS	
m	d	d	d	d	d	d	s	d
0	0.000 000	0.041 667	0.083 333	0.125 000	0.166 667	0.208 333	0	0.000 000
1	.000 694	.042 361	.084 028	.125 694	.167 361	.209 028	1	.000 012
2	.001 389	.043 056	.084 722	.126 389	.168 056	.209 722	2	.000 023
3	.002 083	.043 750	.085 417	.127 083	.168 750	.210 417	3	.000 035
4	.002 778	.044 444	.086 111	.127 778	.169 444	.211 111	4	.000 046
5	0.003 472	0.045 139	0.086 806	0.128 472	0.170 139	0.211 806	5	0.000 058
6	.004 167	.045 833	.087 500	.129 167	.170 833	.212 500	6	.000 069
7	.004 861	.046 528	.088 194	.129 861	.171 528	.213 194	7	.000 081
8	.005 556	.047 222	.088 889	.130 556	.172 222	.213 889	8	.000 093
9	.006 250	.047 917	.089 583	.131 250	.172 917	.214 583	9	.000 104
10	0.006 944	0.048 611	0.090 278	0.131 944	0.173 611	0.215 278	10	0.000 116
11	.007 639	.049 306	.090 972	.132 639	.174 306	.215 972	11	.000 127
12	.008 333	.050 000	.091 667	.133 333	.175 000	.216 667	12	.000 139
13	.009 028	.050 694	.092 361	.134 028	.175 694	.217 361	13	.000 150
14	.009 722	.051 389	.093 056	.134 722	.176 389	.218 056	14	.000 162
15	0.010 417	0.052 083	0.093 750	0.135 417	0.177 083	0.218 750	15	0.000 174
16	.011 111	.052 778	.094 444	.136 111	.177 778	.219 444	16	.000 185
17	.011 806	.053 472	.095 139	.136 806	.178 472	.220 139	17	.000 197
18	.012 500	.054 167	.095 833	.137 500	.179 167	.220 833	18	.000 208
19	.013 194	.054 861	.096 528	.138 194	.179 861	.221 528	19	.000 220
20	0.013 889	0.055 556	0.097 222	0.138 889	0.180 556	0.222 222	20	0.000 231
21	.014 583	.056 250	.097 917	.139 583	.181 250	.222 917	21	.000 243
22	.015 278	.056 944	.098 611	.140 278	.181 944	.223 611	22	.000 255
23	.015 972	.057 639	.099 306	.140 972	.182 639	.224 306	23	.000 266
24	.016 667	.058 333	.100 000	.141 667	.183 333	.225 000	24	.000 278
25	0.017 361	0.059 028	0.100 694	0.142 361	0.184 028	0.225 694	25	0.000 289
26	.018 056	.059 722	.101 389	.143 056	.184 722	.226 389	26	.000 301
27	.018 750	.060 417	.102 083	.143 750	.185 417	.227 083	27	.000 312
28	.019 444	.061 111	.102 778	.144 444	.186 111	.227 778	28	.000 324
29	.020 139	.061 806	.103 472	.145 139	.186 806	.228 472	29	.000 336
30	0.020 833	0.062 500	0.104 167	0.145 833	0.187 500	0.229 167	30	0.000 347
31	.021 528	.063 194	.104 861	.146 528	.188 194	.229 861	31	.000 359
32	.022 222	.063 889	.105 556	.147 222	.188 889	.230 556	32	.000 370
33	.022 917	.064 583	.106 250	.147 917	.189 583	.231 250	33	.000 382
34	.023 611	.065 278	.106 944	.148 611	.190 278	.231 944	34	.000 394
35	0.024 306	0.065 972	0.107 639	0.149 306	0.190 972	0.232 639	35	0.000 405
36	.025 000	.066 667	.108 333	.150 000	.191 667	.233 333	36	.000 417
37	.025 694	.067 361	.109 028	.150 694	.192 361	.234 028	37	.000 428
38	.026 389	.068 056	.109 722	.151 389	.193 056	.234 722	38	.000 440
39	.027 083	.068 750	.110 417	.152 083	.193 750	.235 417	39	.000 451
40	0.027 778	0.069 444	0.111 111	0.152 778	0.194 444	0.236 111	40	0.000 463
41	.028 472	.070 139	.111 806	.153 472	.195 139	.236 806	41	.000 475
42	.029 167	.070 833	.112 500	.154 167	.195 833	.237 500	42	.000 486
43	.029 861	.071 528	.113 194	.154 861	.196 528	.238 194	43	.000 498
44	.030 556	.072 222	.113 889	.155 556	.197 222	.238 889	44	.000 509
45	0.031 250	0.072 917	0.114 583	0.156 250	0.197 917	0.239 583	45	0.000 521
46	.031 944	.073 611	.115 278	.156 944	.198 611	.240 278	46	.000 532
47	.032 639	.074 306	.115 972	.157 639	.199 306	.240 972	47	.000 544
48	.033 333	.075 000	.116 667	.158 333	.200 000	.241 667	48	.000 556
49	.034 028	.075 694	.117 361	.159 028	.200 694	.242 361	49	.000 567
50	0.034 722	0.076 389	0.118 056	0.159 722	0.201 389	0.243 056	50	0.000 579
51	.035 417	.077 083	.118 750	.160 417	.202 083	.243 750	51	.000 590
52	.036 111	.077 778	.119 444	.161 111	.202 778	.244 444	52	.000 602
53	.036 806	.078 472	.120 139	.161 806	.203 472	.245 139	53	.000 613
54	.037 500	.079 167	.120 833	.162 500	.204 167	.245 833	54	.000 625
55	0.038 194	0.079 861	0.121 528	0.163 194	0.204 861	0.246 528	55	0.000 637
56	.038 889	.080 556	.122 222	.163 889	.205 556	.247 222	56	.000 648
57	.039 583	.081 250	.122 917	.164 583	.206 250	.247 917	57	.000 660
58	.040 278	.081 944	.123 611	.165 278	.206 944	.248 611	58	.000 671
59	0.040 972	0.082 639	0.124 306	0.165 972	0.207 639	0.249 306	59	0.000 683

CONVERSION OF HOURS, MINUTES, AND SECONDS TO DECIMALS OF A DAY

m	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	SECONDS	
	d	d	d	d	d	d	s	d
0	0.250 000	0.291 667	0.333 333	0.375 000	0.416 667	0.458 333	0	0.000 000
1	.250 694	.292 361	.334 028	.375 694	.417 361	.459 028	1	.000 012
2	.251 389	.293 056	.334 722	.376 389	.418 056	.459 722	2	.000 023
3	.252 083	.293 750	.335 417	.377 083	.418 750	.460 417	3	.000 035
4	.252 778	.294 444	.336 111	.377 778	.419 444	.461 111	4	.000 046
5	0.253 472	0.295 139	0.336 806	0.378 472	0.420 139	0.461 806	5	0.000 058
6	.254 167	.295 833	.337 500	.379 167	.420 833	.462 500	6	.000 069
7	.254 861	.296 528	.338 194	.379 861	.421 528	.463 194	7	.000 081
8	.255 556	.297 222	.338 889	.380 556	.422 222	.463 889	8	.000 093
9	.256 250	.297 917	.339 583	.381 250	.422 917	.464 583	9	.000 104
10	0.256 944	0.298 611	0.340 278	0.381 944	0.423 611	0.465 278	10	0.000 116
11	.257 639	.299 306	.340 972	.382 639	.424 306	.465 972	11	.000 127
12	.258 333	.300 000	.341 667	.383 333	.425 000	.466 667	12	.000 139
13	.259 028	.300 694	.342 361	.384 028	.425 694	.467 361	13	.000 150
14	.259 722	.301 389	.343 056	.384 722	.426 389	.468 056	14	.000 162
15	0.260 417	0.302 083	0.343 750	0.385 417	0.427 083	0.468 750	15	0.000 174
16	.261 111	.302 778	.344 444	.386 111	.427 778	.469 444	16	.000 185
17	.261 806	.303 472	.345 139	.386 806	.428 472	.470 139	17	.000 197
18	.262 500	.304 167	.345 833	.387 500	.429 167	.470 833	18	.000 208
19	.263 194	.304 861	.346 528	.388 194	.429 861	.471 528	19	.000 220
20	0.263 889	0.305 556	0.347 222	0.388 889	0.430 556	0.472 222	20	0.000 231
21	.264 583	.306 250	.347 917	.389 583	.431 250	.472 917	21	.000 243
22	.265 278	.306 944	.348 611	.390 278	.431 944	.473 611	22	.000 255
23	.265 972	.307 639	.349 306	.390 972	.432 639	.474 306	23	.000 266
24	.266 667	.308 333	.350 000	.391 667	.433 333	.475 000	24	.000 278
25	0.267 361	0.309 028	0.350 694	0.392 361	0.434 028	0.475 694	25	0.000 289
26	.268 056	.309 722	.351 389	.393 056	.434 722	.476 389	26	.000 301
27	.268 750	.310 417	.352 083	.393 750	.435 417	.477 083	27	.000 312
28	.269 444	.311 111	.352 778	.394 444	.436 111	.477 778	28	.000 324
29	.270 139	.311 806	.353 472	.395 139	.436 806	.478 472	29	.000 336
30	0.270 833	0.312 500	0.354 167	0.395 833	0.437 500	0.479 167	30	0.000 347
31	.271 528	.313 194	.354 861	.396 528	.438 194	.479 861	31	.000 359
32	.272 222	.313 889	.355 556	.397 222	.438 889	.480 556	32	.000 370
33	.272 917	.314 583	.356 250	.397 917	.439 583	.481 250	33	.000 382
34	.273 611	.315 278	.356 944	.398 611	.440 278	.481 944	34	.000 394
35	0.274 306	0.315 972	0.357 639	0.399 306	0.440 972	0.482 639	35	0.000 405
36	.275 000	.316 667	.358 333	.400 000	.441 667	.483 333	36	.000 417
37	.275 694	.317 361	.359 028	.400 694	.442 361	.484 028	37	.000 428
38	.276 389	.318 056	.359 722	.401 389	.443 056	.484 722	38	.000 440
39	.277 083	.318 750	.360 417	.402 083	.443 750	.485 417	39	.000 451
40	0.277 778	0.319 444	0.361 111	0.402 778	0.444 444	0.486 111	40	0.000 463
41	.278 472	.320 139	.361 806	.403 472	.445 139	.486 806	41	.000 475
42	.279 167	.320 833	.362 500	.404 167	.445 833	.487 500	42	.000 486
43	.279 861	.321 528	.363 194	.404 861	.446 528	.488 194	43	.000 498
44	.280 556	.322 222	.363 889	.405 556	.447 222	.488 889	44	.000 509
45	0.281 250	0.322 917	0.364 583	0.406 250	0.447 917	0.489 583	45	0.000 521
46	.281 944	.323 611	.365 278	.406 944	.448 611	.490 278	46	.000 532
47	.282 639	.324 306	.365 972	.407 639	.449 306	.490 972	47	.000 544
48	.283 333	.325 000	.366 667	.408 333	.450 000	.491 667	48	.000 556
49	.284 028	.325 694	.367 361	.409 028	.450 694	.492 361	49	.000 567
50	0.284 722	0.326 389	0.368 056	0.409 722	0.451 389	0.493 056	50	0.000 579
51	.285 417	.327 083	.368 750	.410 417	.452 083	.493 750	51	.000 590
52	.286 111	.327 778	.369 444	.411 111	.452 778	.494 444	52	.000 602
53	.286 806	.328 472	.370 139	.411 806	.453 472	.495 139	53	.000 613
54	.287 500	.329 167	.370 833	.412 500	.454 167	.495 833	54	.000 625
55	0.288 194	0.329 861	0.371 528	0.413 194	0.454 861	0.496 528	55	0.000 637
56	.288 889	.330 556	.372 222	.413 889	.455 556	.497 222	56	.000 648
57	.289 583	.331 250	.372 917	.414 583	.456 250	.497 917	57	.000 660
58	.290 278	.331 944	.373 611	.415 278	.456 944	.498 611	58	.000 671
59	0.290 972	0.332 639	0.374 306	0.415 972	0.457 639	0.499 306	59	0.000 683

TABLE XI
CONVERSION OF TIME TO ARC

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	SECONDS						
m	° /	° /	° /	° /	° /	° /	s	'	''	s	'	s	'
0	0 00	15 00	30 00	45 00	60 00	75 00	0	0 00	0.00	0.00	0.50	7.50	
1	0 15	15 15	30 15	45 15	60 15	75 15	1	0 15	.01	0.15	.51	7.65	
2	0 30	15 30	30 30	45 30	60 30	75 30	2	0 30	.02	0.30	.52	7.80	
3	0 45	15 45	30 45	45 45	60 45	75 45	3	0 45	.03	0.45	.53	7.95	
4	1 00	16 00	31 00	46 00	61 00	76 00	4	1 00	.04	0.60	.54	8.10	
5	1 15	16 15	31 15	46 15	61 15	76 15	5	1 15	.05	0.75	.55	8.25	
6	1 30	16 30	31 30	46 30	61 30	76 30	6	1 30	.06	0.90	.56	8.40	
7	1 45	16 45	31 45	46 45	61 45	76 45	7	1 45	.07	1.05	.57	8.55	
8	2 00	17 00	32 00	47 00	62 00	77 00	8	2 00	.08	1.20	.58	8.70	
9	2 15	17 15	32 15	47 15	62 15	77 15	9	2 15	.09	1.35	.59	8.85	
10	2 30	17 30	32 30	47 30	62 30	77 30	10	2 30	.10	1.50	.60	9.00	
11	2 45	17 45	32 45	47 45	62 45	77 45	11	2 45	.11	1.65	.61	9.15	
12	3 00	18 00	33 00	48 00	63 00	78 00	12	3 00	.12	1.80	.62	9.30	
13	3 15	18 15	33 15	48 15	63 15	78 15	13	3 15	.13	1.95	.63	9.45	
14	3 30	18 30	33 30	48 30	63 30	78 30	14	3 30	.14	2.10	.64	9.60	
15	3 45	18 45	33 45	48 45	63 45	78 45	15	3 45	.15	2.25	.65	9.75	
16	4 00	19 00	34 00	49 00	64 00	79 00	16	4 00	.16	2.40	.66	9.90	
17	4 15	19 15	34 15	49 15	64 15	79 15	17	4 15	.17	2.55	.67	10.05	
18	4 30	19 30	34 30	49 30	64 30	79 30	18	4 30	.18	2.70	.68	10.20	
19	4 45	19 45	34 45	49 45	64 45	79 45	19	4 45	.19	2.85	.69	10.35	
20	5 00	20 00	35 00	50 00	65 00	80 00	20	5 00	.20	3.00	.70	10.50	
21	5 15	20 15	35 15	50 15	65 15	80 15	21	5 15	.21	3.15	.71	10.65	
22	5 30	20 30	35 30	50 30	65 30	80 30	22	5 30	.22	3.30	.72	10.80	
23	5 45	20 45	35 45	50 45	65 45	80 45	23	5 45	.23	3.45	.73	10.95	
24	6 00	21 00	36 00	51 00	66 00	81 00	24	6 00	.24	3.60	.74	11.10	
25	6 15	21 15	36 15	51 15	66 15	81 15	25	6 15	.25	3.75	.75	11.25	
26	6 30	21 30	36 30	51 30	66 30	81 30	26	6 30	.26	3.90	.76	11.40	
27	6 45	21 45	36 45	51 45	66 45	81 45	27	6 45	.27	4.05	.77	11.55	
28	7 00	22 00	37 00	52 00	67 00	82 00	28	7 00	.28	4.20	.78	11.70	
29	7 15	22 15	37 15	52 15	67 15	82 15	29	7 15	.29	4.35	.79	11.85	
30	7 30	22 30	37 30	52 30	67 30	82 30	30	7 30	.30	4.50	.80	12.00	
31	7 45	22 45	37 45	52 45	67 45	82 45	31	7 45	.31	4.65	.81	12.15	
32	8 00	23 00	38 00	53 00	68 00	83 00	32	8 00	.32	4.80	.82	12.30	
33	8 15	23 15	38 15	53 15	68 15	83 15	33	8 15	.33	4.95	.83	12.45	
34	8 30	23 30	38 30	53 30	68 30	83 30	34	8 30	.34	5.10	.84	12.60	
35	8 45	23 45	38 45	53 45	68 45	83 45	35	8 45	.35	5.25	.85	12.75	
36	9 00	24 00	39 00	54 00	69 00	84 00	36	9 00	.36	5.40	.86	12.90	
37	9 15	24 15	39 15	54 15	69 15	84 15	37	9 15	.37	5.55	.87	13.05	
38	9 30	24 30	39 30	54 30	69 30	84 30	38	9 30	.38	5.70	.88	13.20	
39	9 45	24 45	39 45	54 45	69 45	84 45	39	9 45	.39	5.85	.89	13.35	
40	10 00	25 00	40 00	55 00	70 00	85 00	40	10 00	.40	6.00	.90	13.50	
41	10 15	25 15	40 15	55 15	70 15	85 15	41	10 15	.41	6.15	.91	13.65	
42	10 30	25 30	40 30	55 30	70 30	85 30	42	10 30	.42	6.30	.92	13.80	
43	10 45	25 45	40 45	55 45	70 45	85 45	43	10 45	.43	6.45	.93	13.95	
44	11 00	26 00	41 00	56 00	71 00	86 00	44	11 00	.44	6.60	.94	14.10	
45	11 15	26 15	41 15	56 15	71 15	86 15	45	11 15	.45	6.75	.95	14.25	
46	11 30	26 30	41 30	56 30	71 30	86 30	46	11 30	.46	6.90	.96	14.40	
47	11 45	26 45	41 45	56 45	71 45	86 45	47	11 45	.47	7.05	.97	14.55	
48	12 00	27 00	42 00	57 00	72 00	87 00	48	12 00	.48	7.20	.98	14.70	
49	12 15	27 15	42 15	57 15	72 15	87 15	49	12 15	.49	7.35	.99	14.85	
50	12 30	27 30	42 30	57 30	72 30	87 30	50	12 30	.50	7.50	1.00	15.00	
51	12 45	27 45	42 45	57 45	72 45	87 45	51	12 45					
52	13 00	28 00	43 00	58 00	73 00	88 00	52	13 00					
53	13 15	28 15	43 15	58 15	73 15	88 15	53	13 15					
54	13 30	28 30	43 30	58 30	73 30	88 30	54	13 30					
55	13 45	28 45	43 45	58 45	73 45	88 45	55	13 45					
56	14 00	29 00	44 00	59 00	74 00	89 00	56	14 00					
57	14 15	29 15	44 15	59 15	74 15	89 15	57	14 15					
58	14 30	29 30	44 30	59 30	74 30	89 30	58	14 30					
59	14 45	29 45	44 45	59 45	74 45	89 45	59	14 45					

6^h = 90°

12^h = 180°

18^h = 270°

CONVERSION OF ARC TO TIME

DEGREES						MINUTES			SECONDS					
°	h	m	°	h	m	°	h	m	°	s	°	s	°	s
0	0	00	60	4	00	120	8	00	0	0 00	0	0.000	0.00	0.000
1	0	04	61	4	04	121	8	04	1	0 04	1	0.067	.01	.001
2	0	08	62	4	08	122	8	08	2	0 08	2	0.133	.02	.001
3	0	12	63	4	12	123	8	12	3	0 12	3	0.200	.03	.002
4	0	16	64	4	16	124	8	16	4	0 16	4	0.267	.04	.003
5	0	20	65	4	20	125	8	20	5	0 20	5	0.333	0.05	0.003
6	0	24	66	4	24	126	8	24	6	0 24	6	0.400	.06	.004
7	0	28	67	4	28	127	8	28	7	0 28	7	0.467	.07	.005
8	0	32	68	4	32	128	8	32	8	0 32	8	0.533	.08	.005
9	0	36	69	4	36	129	8	36	9	0 36	9	0.600	.09	.006
10	0	40	70	4	40	130	8	40	10	0 40	10	0.667	0.10	0.007
11	0	44	71	4	44	131	8	44	11	0 44	11	0.733	.11	.007
12	0	48	72	4	48	132	8	48	12	0 48	12	0.800	.12	.008
13	0	52	73	4	52	133	8	52	13	0 52	13	0.867	.13	.009
14	0	56	74	4	56	134	8	56	14	0 56	14	0.933	.14	.009
15	1	00	75	5	00	135	9	00	15	1 00	15	1.000	0.15	0.010
16	1	04	76	5	04	136	9	04	16	1 04	16	1.067	.16	.011
17	1	08	77	5	08	137	9	08	17	1 08	17	1.133	.17	.011
18	1	12	78	5	12	138	9	12	18	1 12	18	1.200	.18	.012
19	1	16	79	5	16	139	9	16	19	1 16	19	1.267	.19	.013
20	1	20	80	5	20	140	9	20	20	1 20	20	1.333	0.20	0.013
21	1	24	81	5	24	141	9	24	21	1 24	21	1.400	.21	.014
22	1	28	82	5	28	142	9	28	22	1 28	22	1.467	.22	.015
23	1	32	83	5	32	143	9	32	23	1 32	23	1.533	.23	.015
24	1	36	84	5	36	144	9	36	24	1 36	24	1.600	.24	.016
25	1	40	85	5	40	145	9	40	25	1 40	25	1.667	0.25	0.017
26	1	44	86	5	44	146	9	44	26	1 44	26	1.733	.26	.017
27	1	48	87	5	48	147	9	48	27	1 48	27	1.800	.27	.018
28	1	52	88	5	52	148	9	52	28	1 52	28	1.867	.28	.019
29	1	56	89	5	56	149	9	56	29	1 56	29	1.933	.29	.019
30	2	00	90	6	00	150	10	00	30	2 00	30	2.000	0.30	0.020
31	2	04	91	6	04	151	10	04	31	2 04	31	2.067	.31	.021
32	2	08	92	6	08	152	10	08	32	2 08	32	2.133	.32	.021
33	2	12	93	6	12	153	10	12	33	2 12	33	2.200	.33	.022
34	2	16	94	6	16	154	10	16	34	2 16	34	2.267	.34	.023
35	2	20	95	6	20	155	10	20	35	2 20	35	2.333	0.35	0.023
36	2	24	96	6	24	156	10	24	36	2 24	36	2.400	.36	.024
37	2	28	97	6	28	157	10	28	37	2 28	37	2.467	.37	.025
38	2	32	98	6	32	158	10	32	38	2 32	38	2.533	.38	.025
39	2	36	99	6	36	159	10	36	39	2 36	39	2.600	.39	.026
40	2	40	100	6	40	160	10	40	40	2 40	40	2.667	0.40	0.027
41	2	44	101	6	44	161	10	44	41	2 44	41	2.733	.41	.027
42	2	48	102	6	48	162	10	48	42	2 48	42	2.800	.42	.028
43	2	52	103	6	52	163	10	52	43	2 52	43	2.867	.43	.029
44	2	56	104	6	56	164	10	56	44	2 56	44	2.933	.44	.029
45	3	00	105	7	00	165	11	00	45	3 00	45	3.000	0.45	0.030
46	3	04	106	7	04	166	11	04	46	3 04	46	3.067	.46	.031
47	3	08	107	7	08	167	11	08	47	3 08	47	3.133	.47	.031
48	3	12	108	7	12	168	11	12	48	3 12	48	3.200	.48	.032
49	3	16	109	7	16	169	11	16	49	3 16	49	3.267	.49	.033
50	3	20	110	7	20	170	11	20	50	3 20	50	3.333	0.50	0.033
51	3	24	111	7	24	171	11	24	51	3 24	51	3.400		
52	3	28	112	7	28	172	11	28	52	3 28	52	3.467		
53	3	32	113	7	32	173	11	32	53	3 32	53	3.533		
54	3	36	114	7	36	174	11	36	54	3 36	54	3.600		
55	3	40	115	7	40	175	11	40	55	3 40	55	3.667		
56	3	44	116	7	44	176	11	44	56	3 44	56	3.733		
57	3	48	117	7	48	177	11	48	57	3 48	57	3.800		
58	3	52	118	7	52	178	11	52	58	3 52	58	3.867		
59	3	56	119	7	56	179	11	56	59	3 56	59	3.933		

90° = 6^h

180° = 12^h

270° = 18^h

NOTATION

Arg. Function		Differences				$f(t_p)=f(t_0+ph)=f_p$
		1st	2nd	3rd	4th	$\delta_p=f_{p+\frac{1}{2}}-f_{p-\frac{1}{2}} \quad \delta_p^2=\delta(\delta_p)$
t_{-2}	f_{-2}					$\delta_{\frac{1}{2}}=f_1-f_0 \quad \delta_0^2+\delta_1^2=\delta_{1\frac{1}{2}}-\delta_{-\frac{1}{2}}$
t_{-1}	f_{-1}	$\delta_{-1\frac{1}{2}}$	δ_{-1}^2			$\delta_0^2=\delta_{\frac{1}{2}}-\delta_{-\frac{1}{2}}=f_1-2f_0+f_{-1}$
t_0	f_0	$\delta_{-\frac{1}{2}}$	δ_0^2	$\delta_{\frac{1}{2}}^3$	δ_0^4	$\delta_{\frac{1}{2}}^3=\delta_1^2-\delta_0^2=f_2-3f_1+3f_0-f_{-1}$
t_1	f_1	$\delta_{\frac{1}{2}}$	δ_1^2			$\delta_0^4=\delta_{\frac{1}{2}}^3-\delta_{-\frac{1}{2}}^3=f_2-4f_1+6f_0-4f_{-1}+f_{-2}$
t_2	f_2	$\delta_{1\frac{1}{2}}$				

BESSEL'S INTERPOLATION FORMULA

$f_p=f_0+p\delta_{\frac{1}{2}}+B_2(\delta_0^2+\delta_1^2)+B_3\delta_{\frac{1}{2}}^3+B_4(\delta_0^4+\delta_1^4)+ \dots$

The maximum truncation error of the interpolate f_p from neglecting each order of difference is less than 0.5 in the unit of the end figure of the tabular function if

$\delta^2 < 4 \quad \delta^3 < 60 \quad \delta^4 < 20 \quad \delta^5 < 500$

If δ^2 is replaced by $\delta_m^2=\delta^2-0.184 \delta^4$, the corresponding limit for δ^4 is raised to 1000; $\delta_{\frac{1}{2}}^3$ may be replaced by $\delta_{m1}^2-\delta_{m0}^2$.

PRECEPTS FOR USING THE TABLES

Table XIII. Round the interpolating factor p to 4 decimals; the required value of B_2 is the tabular value opposite the interval in which p lies or, if p exactly equals a tabular argument, the value above and to the right of p . The effects of third and fourth differences can be estimated from the values of B_3 and B_4 in the last column.

Table XIV. The table is entered with the tabular arguments nearest the true values of p and $\delta_0^2+\delta_1^2$, to obtain directly the value of the second-difference correction; this correction always has the opposite sign to $\delta_0^2+\delta_1^2$.

Table XV. The value of B_2 may be obtained by mental linear interpolation since the first difference of B_2 is never greater than 4. The corrections for third and fourth differences, which are usually necessary when Table XIII cannot be used, are taken from the Tables XVI and XVII; these tables are similar to Table XIV, but include a guarding decimal, and require mental interpolation for some ranges of the argument, to reduce the error of the interpolate.

Errors. In addition to the truncation error, an interpolate is subject to errors from the following sources:

		Maximum error
$f_0+p\delta_{\frac{1}{2}}$	Rounding errors in f_0, f_1	0.5
$B_2(\delta_0^2+\delta_1^2)+B_3\delta_{\frac{1}{2}}^3+ \dots$	Rounding errors in tabular values	0.2
$B_2(\delta_0^2+\delta_1^2)$	Rounding error of B_2 from Table XIII	$0.00051(\delta_0^2-\delta_1^2)$
$B_2(\delta_0^2+\delta_1^2)$	Table XIV, using nearest arguments	0.7
$B_2(\delta_0^2+\delta_1^2)$	Error of B_2 from Table XV	$0.00011(\delta_0^2-\delta_1^2)$
$B_3\delta_{\frac{1}{2}}^3+B_4(\delta_0^4+\delta_1^4)$	Tables XVI and XVII, with mental interpolation	0.3
f_p	Final rounding error	0.5

EXAMPLES

To find (a) the right ascension of the Sun, and (b) the horizontal parallax of the Moon, at 16^h 23^m 15^s.9 E. T., on 1960 January 4. The tabular values, and their differences in units of the end figure of the functions, are:

1960	R.A. of Sun			δ	δ^2	1960	H.P. of Moon		δ	δ^2	δ^3	δ^4
Jan.	_h	_m	_s			Jan.	'	"				
3.0	18	50	30.27	+26452	-36	4.0	57	08.023	-27214	+1211	+386	-83
4.0	18	54	54.79	+26413	-39	4.5	56	40.809	-25617	+1597	+303	-83
5.0	18	59	18.92	+26369	-44	5.0	56	15.192	-23717	+1900	+227	-76
6.0	19	03	42.61		-44	5.5	55	51.475		+2127		-69

(a) The tabular interval is one day; the interpolating factor p is therefore 0.68282. From Table XIII, $B_2 = -0.054$; and

$$f_p = 18^h 54^m 54^s.79 + 0.68282(+264^s.13) - 0.054(-0^s.39 - 0^s.44) = 18^h 57^m 55^s.19$$

Alternatively, from Table XIV, with arguments $p = 0.68$, $\delta_0^2 + \delta_1^2 = 85$, the second-difference correction $B_2(\delta_0^2 + \delta_1^2) = 5$; and

$$f_p = 18^h 54^m 54^s.79 + 0.68282(+264^s.13) + 0^s.05 = 18^h 57^m 55^s.19$$

(b) The tabular interval is 0^s.5; the interpolating factor p is therefore 0.36564. From Table XV, $B_2 = -0.0580$; from Table XVI, $B_3\delta_0^3 = 1.5$, using $p = 0.366$, $\delta_0^3 = 300$; from Table XVII, $B_4(\delta_0^4 + \delta_1^4) = 1.7$, using $p = 0.366$, $\delta_0^4 + \delta_1^4 = 160$; and

$$f_p = 56' 40'' 809 + 0.36564(-25'' 617) - 0.0580(+1'' 597 + 1'' 900) + 0'' 0015 - 0'' 0017 = 56' 31'' 239$$

TABLE XIII. BESSEL COEFFICIENTS B_2, B_3, B_4

p	B_2	p	B_2	p	B_2	p	B_2	p	B_2	p	B_3
0.0000	.000	0.1101	.025	0.2719	.050	0.7280	.049	0.8898	.024	0.0	0.000
.0020	.001	.1152	.026	.2809	.051	.7366	.048	.8949	.023	.1	+ .006
.0060	.001	.1205	.026	.2902	.051	.7449	.048	.9000	.023	.2	.008
.0101	.002	.1258	.027	.3000	.052	.7529	.047	.9049	.022	.3	.007
.0142	.003	.1312	.028	.3102	.053	.7607	.046	.9098	.021	.4	+ .004
.0183	.004	.1366	.029	.3211	.054	.7683	.045	.9147	.020	.5	0.000
.0225	.005	.1422	.030	.3326	.055	.7756	.044	.9195	.019	.6	- .004
.0267	.006	.1478	.031	.3450	.056	.7828	.043	.9242	.018	.7	.007
.0309	.007	.1535	.032	.3585	.057	.7898	.042	.9289	.017	.8	.008
.0352	.008	.1594	.033	.3735	.058	.7966	.041	.9335	.016	.9	- .006
.0395	.009	.1653	.034	.3904	.059	.8033	.040	.9381	.015	1.0	0.000
.0439	.010	.1713	.035	.4105	.060	.8098	.039	.9427	.014	$p \quad B_4$	
.0483	.011	.1775	.036	.4367	.061	.8162	.038	.9472	.013		
.0527	.012	.1837	.037	.4632	.062	.8224	.037	.9516	.012	0.0	0.000
.0572	.013	.1901	.038	.4894	.061	.8286	.036	.9560	.011	.1	+ .004
.0618	.014	.1966	.039	.5159	.060	.8346	.035	.9604	.010	.2	.007
.0664	.015	.2033	.040	.5426	.059	.8405	.034	.9647	.009	.3	.010
.0710	.016	.2101	.041	.5694	.058	.8464	.033	.9690	.008	.4	.011
.0757	.017	.2171	.042	.5964	.057	.8521	.032	.9732	.007	.5	+0.012
.0804	.018	.2243	.043	.6235	.056	.8577	.031	.9774	.006	.6	.011
.0852	.019	.2316	.044	.6507	.055	.8633	.030	.9816	.005	.7	.010
.0901	.020	.2392	.045	.6780	.054	.8687	.029	.9857	.004	.8	.007
.0950	.021	.2470	.046	.7054	.053	.8741	.028	.9898	.003	.9	+ .004
.1000	.022	.2550	.047	.7329	.052	.8794	.027	.9939	.002	1.0	0.000
.1050	.023	.2633	.048	.7604	.051	.8847	.026	0.9979	.001		
0.1101	.024	0.2719	.049	0.7880	.050	0.8898	.025	1.0000	.000		

In critical cases ascend.
 B_2 is always negative.

TABLE XIV. SECOND-DIFFERENCE CORRECTION $B_2(\delta_0^2 + \delta_1^2)$

p	Double second difference $\delta_0^2 + \delta_1^2$																					p
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	
0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.99
.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	.98
.03	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	.97
.04	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	.96
0.05	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.95
.06	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	2	.94
.07	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	.93
.08	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	.92
.09	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	.91
0.10	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	0.90
.11	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	.89
.12	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	.88
.13	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	.87
.14	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	.86
0.15	0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	0.85
.16	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	.84
.17	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	.83
.18	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	4	4	4	.82
.19	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	.81
0.20	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	0.80
.21	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	5	.79
.22	0	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	.78
.23	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4	4	5	.77
.24	0	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	.76
0.25	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	4	5	5	0.75
.26	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	.74
.27	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	.73
.28	1	1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.72
.29	1	1	1	1	1	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	6	.71
0.30	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	0.70
.31	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.69
.32	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.68
.33	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.67
.34	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.66
0.35	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	5	6	6	0.65
.36	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	5	6	6	.64
.37	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	6	.63
.38	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	6	.62
.39	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.61
0.40	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	0.60
.41	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.59
.42	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.58
.43	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.57
.44	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.56
0.45	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	0.55
.46	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.54
.47	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.53
.48	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.52
.49	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	.51
0.50	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	0.50

The correction has the opposite sign to $\delta_0^2 + \delta_1^2$.

TABLE XIV. SECOND-DIFFERENCE CORRECTION $B_2(\delta_0^2 + \delta_1^2)$

p	Double second difference $\delta_0^2 + \delta_1^2$																		p
	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	
0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.99
.02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.98
.03	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.97
.04	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	.96
0.05	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0.95
.06	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	.94
.07	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	.93
.08	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	4	4	.92
.09	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	.91
0.10	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	0.90
.11	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	.89
.12	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	5	5	.88
.13	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5	5	6	6	.87
.14	3	4	4	4	4	4	4	5	5	5	5	5	5	5	6	6	6	6	.86
0.15	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	0.85
.16	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	7	7	.84
.17	4	4	4	5	5	5	5	5	5	6	6	6	6	6	7	7	7	7	.83
.18	4	4	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	.82
.19	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	.81
0.20	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	0.80
.21	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	.79
.22	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	9	.78
.23	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	.77
.24	5	5	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	.76
0.25	5	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	0.75
.26	6	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	.74
.27	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	.73
.28	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	.72
.29	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	10	.71
0.30	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	0.70
.31	6	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	11	.69
.32	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	.68
.33	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	.67
.34	6	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	.66
0.35	7	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	11	0.65
.36	7	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	.64
.37	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	.63
.38	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	11	12	.62
.39	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	.61
0.40	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	11	12	0.60
.41	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	.59
.42	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	12	12	12	.58
.43	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	12	12	12	.57
.44	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	.56
0.45	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	12	0.55
.46	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	12	.54
.47	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.53
.48	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.52
.49	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.51
0.50	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	0.50

If third and fourth differences are negligible $f_p = f_0 + p\delta_1 + B_2(\delta_0^2 + \delta_1^2)$.

TABLE XV. SECOND-DIFFERENCE COEFFICIENT B_2

p	B_2	p	p	B_2	p	p	B_2	p	p	B_2	p
0.000	-0.0000	1.000	0.035	-0.0084	0.965	0.070	-0.0163	0.930	0.105	-0.0235	0.895
.001	02	.999	.036	87	.964	.071	165	.929	.106	237	.894
.002	05	.998	.037	89	.963	.072	167	.928	.107	239	.893
.003	07	.997	.038	91	.962	.073	169	.927	.108	241	.892
.004	10	.996	.039	94	.961	.074	171	.926	.109	243	.891
0.005	-0.0012	0.995	0.040	-0.0096	0.960	0.075	-0.0173	0.925	0.110	-0.0245	0.890
.006	15	.994	.041	098	.959	.076	176	.924	.111	247	.889
.007	17	.993	.042	101	.958	.077	178	.923	.112	249	.888
.008	20	.992	.043	103	.957	.078	180	.922	.113	251	.887
.009	22	.991	.044	105	.956	.079	182	.921	.114	253	.886
0.010	-0.0025	0.990	0.045	-0.0107	0.955	0.080	-0.0184	0.920	0.115	-0.0254	0.885
.011	27	.989	.046	110	.954	.081	186	.919	.116	256	.884
.012	30	.988	.047	112	.953	.082	188	.918	.117	258	.883
.013	32	.987	.048	114	.952	.083	190	.917	.118	260	.882
.014	35	.986	.049	116	.951	.084	192	.916	.119	262	.881
0.015	-0.0037	0.985	0.050	-0.0119	0.950	0.085	-0.0194	0.915	0.120	-0.0264	0.880
.016	39	.984	.051	121	.949	.086	197	.914	.121	266	.879
.017	42	.983	.052	123	.948	.087	199	.913	.122	268	.878
.018	44	.982	.053	125	.947	.088	201	.912	.123	270	.877
.019	47	.981	.054	128	.946	.089	203	.911	.124	272	.876
0.020	-0.0049	0.980	0.055	-0.0130	0.945	0.090	-0.0205	0.910	0.125	-0.0273	0.875
.021	51	.979	.056	132	.944	.091	207	.909	.126	275	.874
.022	54	.978	.057	134	.943	.092	209	.908	.127	277	.873
.023	56	.977	.058	137	.942	.093	211	.907	.128	279	.872
.024	59	.976	.059	139	.941	.094	213	.906	.129	281	.871
0.025	-0.0061	0.975	0.060	-0.0141	0.940	0.095	-0.0215	0.905	0.130	-0.0283	0.870
.026	63	.974	.061	143	.939	.096	217	.904	.131	285	.869
.027	66	.973	.062	145	.938	.097	219	.903	.132	286	.868
.028	68	.972	.063	148	.937	.098	221	.902	.133	288	.867
.029	70	.971	.064	150	.936	.099	223	.901	.134	290	.866
0.030	-0.0073	0.970	0.065	-0.0152	0.935	0.100	-0.0225	0.900	0.135	-0.0292	0.865
.031	75	.969	.066	154	.934	.101	227	.899	.136	294	.864
.032	77	.968	.067	156	.933	.102	229	.898	.137	296	.863
.033	80	.967	.068	158	.932	.103	231	.897	.138	297	.862
.034	82	.966	.069	161	.931	.104	233	.896	.139	299	.861
0.035	-0.0084	0.965	0.070	-0.0163	0.930	0.105	-0.0235	0.895	0.140	-0.0301	0.860

TABLE XVI. THIRD-DIFFERENCE CORRECTION $B_3\delta_y^3$

Interpolating factor p : correction has same sign as difference δ_y^3																	
δ_y^3	0.00	0.02	0.04	0.06	0.08	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.42	0.44	0.46	0.48	0.50
100	0.0	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.7	0.6	0.4	0.3	0.2	0.2	0.1	0.0
200	0.0	0.3	0.6	0.8	1.0	1.2	1.5	1.6	1.6	1.4	1.1	0.8	0.6	0.5	0.3	0.2	0.0
300	0.0	0.5	0.9	1.2	1.5	1.8	2.2	2.4	2.3	2.1	1.7	1.2	1.0	0.7	0.5	0.2	0.0
400	0.0	0.6	1.2	1.7	2.1	2.4	3.0	3.2	3.1	2.8	2.3	1.6	1.3	1.0	0.7	0.3	0.0
500	0.0	0.8	1.5	2.1	2.6	3.0	3.7	4.0	3.9	3.5	2.8	2.0	1.6	1.2	0.8	0.4	0.0
600	0.0	1.0	1.8	2.5	3.1	3.6	4.5	4.8	4.7	4.2	3.4	2.4	1.9	1.5	1.0	0.5	0.0
700	0.0	1.1	2.1	2.9	3.6	4.2	5.2	5.6	5.5	4.9	4.0	2.8	2.3	1.7	1.2	0.6	0.0
800	0.0	1.3	2.4	3.3	4.1	4.8	6.0	6.4	6.2	5.6	4.6	3.2	2.6	2.0	1.3	0.7	0.0
900	0.0	1.4	2.6	3.7	4.6	5.4	6.7	7.2	7.0	6.3	5.1	3.6	2.9	2.2	1.5	0.7	0.0
1000	0.0	1.6	2.9	4.1	5.2	6.0	7.4	8.0	7.8	7.0	5.7	4.0	3.2	2.5	1.7	0.8	0.0
	1.00	0.98	0.96	0.94	0.92	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.58	0.56	0.54	0.52	0.50

Interpolating factor p : correction has opposite sign to difference δ_y^3

$$f_p = f_o + p\delta_{1/2} + B_2(\delta_o^2 + \delta_1^2) + B_3\delta_{1/2}^3 + B_4(\delta_o^4 + \delta_1^4)$$

TABLE XV. SECOND-DIFFERENCE COEFFICIENT B_2

p	B_2	p	p	B_2	p	p	B_2	p	p	B_2	p
0.140	-0.0301	0.860	0.210	-0.0415	0.790	0.280	-0.0504	0.720	0.350	-0.0569	0.650
.142	305	.858	.212	418	.788	.282	506	.718	.355	572	.645
.144	308	.856	.214	421	.786	.284	508	.716	.360	576	.640
.146	312	.854	.216	423	.784	.286	511	.714	.365	579	.635
.148	315	.852	.218	426	.782	.288	513	.712	.370	583	.630
0.150	-0.0319	0.850	0.220	-0.0429	0.780	0.290	-0.0515	0.710	0.375	-0.0586	0.625
.152	322	.848	.222	432	.778	.292	517	.708	.380	589	.620
.154	326	.846	.224	435	.776	.294	519	.706	.385	592	.615
.156	329	.844	.226	437	.774	.296	521	.704	.390	595	.610
.158	333	.842	.228	440	.772	.298	523	.702	.395	597	.605
0.160	-0.0336	0.840	0.230	-0.0443	0.770	0.300	-0.0525	0.700	0.400	-0.0600	0.600
.162	339	.838	.232	445	.768	.302	527	.698	.405	602	.595
.164	343	.836	.234	448	.766	.304	529	.696	.410	605	.590
.166	346	.834	.236	451	.764	.306	531	.694	.415	607	.585
.168	349	.832	.238	453	.762	.308	533	.692	.420	609	.580
0.170	-0.0353	0.830	0.240	-0.0456	0.760	0.310	-0.0535	0.690	0.425	-0.0611	0.575
.172	356	.828	.242	459	.758	.312	537	.688	.430	613	.570
.174	359	.826	.244	461	.756	.314	539	.686	.435	614	.565
.176	363	.824	.246	464	.754	.316	540	.684	.440	616	.560
.178	366	.822	.248	466	.752	.318	542	.682	.445	617	.555
0.180	-0.0369	0.820	0.250	-0.0469	0.750	0.320	-0.0544	0.680	0.450	-0.0619	0.550
.182	372	.818	.252	471	.748	.322	546	.678	.455	620	.545
.184	375	.816	.254	474	.746	.324	548	.676	.460	621	.540
.186	379	.814	.256	476	.744	.326	549	.674	.465	622	.535
.188	382	.812	.258	479	.742	.328	551	.672	.470	623	.530
0.190	-0.0385	0.810	0.260	-0.0481	0.740	0.330	-0.0553	0.670	0.475	-0.0623	0.525
.192	388	.808	.262	483	.738	.332	554	.668	.480	624	.520
.194	391	.806	.264	486	.736	.334	556	.666	.485	624	.515
.196	394	.804	.266	488	.734	.336	558	.664	.490	625	.510
.198	397	.802	.268	490	.732	.338	559	.662	.495	625	.505
0.200	-0.0400	0.800	0.270	-0.0493	0.730	0.340	-0.0561	0.660	0.500	-0.0625	0.500
.202	403	.798	.272	495	.728	.342	563	.658	.505	625	.495
.204	406	.796	.274	497	.726	.344	564	.656	.510	625	.490
.206	409	.794	.276	500	.724	.346	566	.654	.515	624	.485
.208	412	.792	.278	502	.722	.348	567	.652	.520	624	.480
0.210	-0.0415	0.790	0.280	-0.0504	0.720	0.350	-0.0569	0.650	0.525	-0.0623	0.475

TABLE XVII. FOURTH-DIFFERENCE CORRECTION $B_4(\delta_0^4 + \delta_1^4)$ Interpolating factor p : correction has same sign as difference $(\delta_0^4 + \delta_1^4)$

$\delta_0^4 + \delta_1^4$	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.25	0.30	0.35	0.40	0.50
50	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6
100	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.9	1.0	1.1	1.1	1.2
150	0.0	0.1	0.2	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.6	1.7	1.8
200	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.4	1.7	1.9	2.1	2.2	2.3
250	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.3	1.5	1.7	1.8	2.1	2.4	2.6	2.8	2.9
300	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.6	2.9	3.2	3.4	3.5
350	0.0	0.3	0.6	0.8	1.1	1.4	1.6	1.9	2.1	2.3	2.5	3.0	3.4	3.7	3.9	4.1
400	0.0	0.3	0.6	1.0	1.3	1.6	1.8	2.1	2.4	2.6	2.9	3.4	3.9	4.2	4.5	4.7
450	0.0	0.4	0.7	1.1	1.4	1.8	2.1	2.4	2.7	3.0	3.2	3.8	4.4	4.8	5.0	5.3
500	0.0	0.4	0.8	1.2	1.6	2.0	2.3	2.7	3.0	3.3	3.6	4.3	4.8	5.3	5.6	5.9
1.00	0.98	0.96	0.94	0.92	0.90	0.88	0.86	0.84	0.82	0.80	0.75	0.70	0.65	0.60	0.50	

Interpolating factor p : correction has same sign as difference $(\delta_0^4 + \delta_1^4)$

$$f_p = f_0 + p\delta_{12} + B_2(\delta_0^3 + \delta_1^3) + B_3\delta_{12}^3 + B_4(\delta_0^4 + \delta_1^4)$$

EXPLANATION

The following description of the contents of this volume is limited to explaining the precise meanings of the tabular quantities, and specifying the basic tables used in the computations and the values adopted for the fundamental constants. A separate volume, *Explanatory Supplement*, contains a more detailed explanation of the ephemerides, and includes the formulae and auxiliary tables that are used in making the calculations.

Beginning with the volume for 1960, the tabular argument in the fundamental ephemerides of the Sun, Moon, and planets is Ephemeris Time; in nearly all of the other ephemerides, the argument is Universal Time. Ephemeris Time is the uniform measure of time defined by the laws of dynamics and determined in principle from the orbital motions of the planets, specifically the *orbital motion of the Earth* as represented by NEWCOMB'S *Tables of the Sun*. Universal Time is defined by the *rotational motion of the Earth*, and is determined from the apparent diurnal motions which reflect this rotation; because of variations in the rate of the rotation, Universal Time is not rigorously uniform.

Ephemeris Time is the independent variable in the gravitational theories of the Sun, Moon, and planets. The actual argument of ephemerides computed from these gravitational theories is necessarily Ephemeris Time defined by the laws of motion, instead of Universal Time defined by the variable rotation of the Earth; but in the volumes for years preceding 1960, the distinction was not formally recognized, and the arguments of the ephemerides were designated as Universal Time.

A gravitational ephemeris expresses the position of a celestial body as a function of Ephemeris Time; and, at any instant, the measure of Ephemeris Time is the value of the argument at which the ephemeris position is the same as the actual position at the instant. That is, the measure of time is determined by the inverse relation expressing the time as a function of the position, and this relation is the practical means of determining its numerical value. The Ephemeris Time at any instant is obtained from observation by directly comparing observed positions of the Sun, Moon, and planets with gravitational ephemerides of their coordinates; observations of the Moon are the most effective and expeditious for this purpose. An accurate determination, however, requires observations over a more or less extended period; in practice, it takes the form of determining the correction ΔT that must be applied to Universal Time to obtain Ephemeris Time:

$$E.T. = U.T. + \Delta T.$$

The Universal Time at any instant may be obtained with little delay from observations of the diurnal motions.

The numerical measure in which Ephemeris Time is reckoned is defined by the apparent *annual motion of the Sun in longitude*. Universal Time, in principle, is determined by the *average rate of the apparent diurnal motion of the Sun relative to the meridian of Greenwich*; but in practice, the numerical measure of Universal Time at any instant is formally computed from its relation to the measure of time defined by the diurnal motion of the vernal equinox (First Point of Aries), which is known as *sidereal time* and which may be rapidly and accurately determined from observations of the diurnal motions of stars.

Universal Time is a particular case of the measure known in general as *mean solar time*. A reckoning of time which conforms more or less closely to the recurrence of daylight and darkness determined by the diurnal motion of the Sun, and which is quickly obtainable with high precision from observation, is a practical necessity; but because of the variations in the rate of motion in hour angle due to the inequalities in the annual motion of the Sun along the ecliptic and to the inclination of the ecliptic to the equator, the measure of time that is directly defined by the actual diurnal motion of the Sun, known as *apparent solar time*, is impracticable for the purpose of precise timekeeping. Instead, mean solar time is introduced, defined by the apparent diurnal motion of a conventional fiducial point located on the mean celestial equator of date, and characterized by a uniform sidereal motion along the equator at a rate which is virtually equal to the mean rate of the annual motion of the Sun along the ecliptic; relative to any meridian of longitude, this point has a diurnal motion in hour angle virtually the same as the average diurnal motion of the Sun, and uniform except for variations of the local meridian and variations of the rate of rotation of the Earth.

The position of this moving point is abstractly defined by a conventional formula for its right ascension; the practice in the past has been to adopt for the right ascension an expression as nearly identical with the expression for the mean longitude of the Sun on the ecliptic as is possible, consistent with a sidereal motion at a constant rate. The position in right ascension differs from the mean longitude of the Sun by only a slight, progressively increasing, excess of $0^{\text{s}}0203 T^2$ due to the secular acceleration of the Sun, where T is the number of centuries after 1900. The position in hour angle is never more than about 16^{m} from the Sun. This abstract fiducial point, formally defined by the conventional expression for its right ascension, has therefore traditionally been known as the fictitious mean sun.

Unlike the diurnal motion of the actual Sun which defines apparent solar time, the diurnal motion of the fictitious mean sun which defines mean solar time cannot be actually observed, since this fiducial point has no physical counterpart; but the expression for its right ascension fixes its position among the stars at every instant, and is a means of determining its diurnal motion from the observable diurnal motions of the stars, and conventionally defining an exact measure of mean solar time by expressing the definition in the form of a relation to sidereal time. The sidereal time defined by the diurnal motion of the vernal equinox is measured by the hour angle of the equinox, which represents the position of the equinox in its diurnal circuit; its value at any instant is determined by observing meridian transits of stars.

From the formula for the right ascension of the fictitious mean sun, the numerical expression is obtained that formally defines the conventional measure of mean solar time by prescribing its relation to the sidereal time measured by the hour angle of the equinox. In practice, the hour angles of the equinox that determine the instants of successive mean midnights are calculated from this relation; and with them, the mean solar time at any instant is calculated from the observed hour angle of the equinox at this instant. The ephemeris of *Universal and Sidereal Times* on pages 10–17, containing the calculated sidereal time at 0^h U.T., is for this purpose. Universal Time is the mean solar time on the Greenwich meridian, reckoned in days of 24 mean solar hours beginning with 0^h at midnight; and the tabular sidereal times at 0^h U.T. are the Greenwich hour angles of the vernal equinox that conventionally *define* the instants of successive Greenwich mean midnights.

The period of one diurnal circuit of the equinox in hour angle, between two consecutive upper meridian transits, is a sidereal day; it is divided into 24 sidereal hours, reckoned from 0^h at upper transit which is known as sidereal noon. The *true* equinox is at the intersection of the true equator of date with the ecliptic of date; the time measured by its diurnal motion is *apparent sidereal time*. The position of the true equinox is affected by the nutation of the axis of rotation of the Earth; and the nutation consequently introduces irregular periodic inequalities into the apparent sidereal time and the length of the sidereal day. The time measured by the diurnal motion of the *mean* equinox of date, which is affected by only the secular inequalities due to the precession of the axis, is *mean sidereal time*. Apparent sidereal time minus mean sidereal time is the *equation of the equinoxes* due to the nutation; in the volumes immediately preceding 1960, it was designated as the nutation in right ascension, and was included in the ephemeris of the Sun.

The tabular values of the Greenwich mean sidereal time at 0^h Universal Time on successive dates are computed from NEWCOMB's expression,

$$6^{\text{h}} 38^{\text{m}} 45^{\text{s}}.836 + 86\ 40184^{\text{s}}.542\ T + 0^{\text{s}}.0929\ T^2,$$

where, for any date, T denotes the number of Julian centuries of 36525 days which, at midnight of the beginning of the day, have elapsed since noon on 1900 January 0 at the Greenwich meridian. The apparent sidereal time is obtained by adding the equation of the equinoxes to the mean sidereal time.

The instant that is designated as 0^h U.T. each day is the instant at which the vernal equinox during its apparent diurnal motion reaches a Greenwich hour angle equal to the value calculated from this formula with the numerical value of T that represents the integral number of days from the epoch to date. At the instant of any observed Greenwich sidereal time, the interval which has elapsed since 0^h U.T., expressed in sidereal units, is immediately obtained by subtracting the tabular sidereal time at 0^h U.T. from the observed sidereal time at the instant; and the Universal Time at the instant is the equivalent measure of this interval in units of mean solar time.

The mean solar day, of 24 mean solar hours, is the interval of time between the two instants at which the equinox reaches the tabular hour angles for two

consecutive dates, corrected for the variations of the meridian due to the motion of the geographic poles and to variations of the vertical. Because of the dependence of the diurnal motion on the rate of rotation of the Earth, the variations of the rotation cause inequalities in the mean solar time as determined from these tabular hour angles of the equinox, and the mean solar day is not invariable in length; but the ratio of the sidereal and mean solar measures of time is not changed by variations of the rotation of the Earth, since the two measures are affected proportionally. The ratio of the mean solar day to the mean sidereal day is 1.00273 79093; and the equivalent measures of the length of the day are:

Mean sidereal day . . . 23^h 56^m 04^s.09054 of mean solar time

Mean solar day 24^h 03^m 56^s.55536 of mean sidereal time

From these equivalents, Tables VIII and IX have been constructed for converting intervals of time from one measure to the other. To the order of accuracy of 0^s.01, these tables may be used for either mean or apparent sidereal time; but in more precise calculations, separate account must be taken of the equation of the equinoxes. The measure of an interval expressed in hours, minutes, and seconds may be converted to the equivalent fraction of a day by Table X.

The expression for the value of the hour angle of the equinox which defines 0^h U.T. is obtained by adding 12^h to NEWCOMB's expression for the right ascension of the fictitious mean sun, originally in order that mean midnight would be the instant of lower meridian transit of the fictitious mean sun, and the measure of mean solar time at any other instant, reckoned from midnight, would be the hour angle of the fictitious mean sun increased by 12^h. Accordingly, prior to 1960, the additional designation "Right Ascension of Mean Sun + 12^h" was sometimes given to the sidereal time at 0^h U.T. However, because of the variations in the rate of rotation of the Earth, the measure actually obtained by the established practical method of determining Universal Time does not rigorously conform to this traditional geometric interpretation.

In actual practice, the tabular values of the hour angle of the equinox at successive intervals of a mean solar day are formally calculated from successive values of T at the *numerically uniform* interval 1/36525. Numerically, therefore, the tabular values are at equal intervals of the sidereal motion of the fictitious mean sun in right ascension, since NEWCOMB's expression, *by construction*, represents a strictly uniform sidereal motion with respect to T . However, the instants at which the equinox reaches the tabular hour angles in its diurnal motion depend on the variable rotation of the Earth, and are at slightly unequal intervals of time; during these successive intervals the actual amounts of the uniform sidereal motion of the mean sun are unequal. The right ascension of the mean sun is independent of the rotation of the Earth; but the diurnal motion of the equinox in hour angle is determined by the rotation of the Earth and by the sidereal motion of the equinox due to precession. The sidereal motion of the equinox is independent of the rotation, and affects the hour angle of the equinox and the right ascension of the mean sun alike; but in the motion that is due to the rotation of the Earth, the equinox requires

a varying interval of time to describe the tabular interval of hour angle between consecutive midnights, including the constant tabular amount due to the sidereal motion of the mean sun. Consequently, the hour angle of the equinox, and the actual right ascension of the mean sun increased by 12^h , do not both reach the tabular value of the sidereal time of 0^h U.T. at identically the same instant.

The tabular value is the hour angle which the *equinox* reaches at mean midnight *by definition*, but is not precisely equal numerically to the right ascension of the mean sun increased by 12^h at this instant; this former designation is inexact when the variation of mean solar time from a uniform measure is recognized, and was therefore eliminated from the ephemeris when a formal distinction was made between Universal Time and Ephemeris Time. At this hour angle of the equinox the fictitious mean sun is not exactly on the lower meridian. The instant of 0^h U.T. is precisely defined, not by the meridian transit of the mean sun, but abstractly by the numerical expression from which the tabular sidereal times at 0^h U.T. are computed; and the traditional descriptive definition of mean solar time as the hour angle of the mean sun increased by 12^h is not an exact equivalent of the actual conventional measure.

The operational procedure used in practice for determining the Universal Time at any instant constitutes the actual definition, and supersedes the geometric interpretation that originally motivated this procedure before variations in the rotation of the Earth had been recognized. Universal Time as obtained in accordance with the established practical method, from the observed sidereal time at the instant and the tabular sidereal time at 0^h U.T., is essentially a formal measure defined by the abstract numerical expression conventionally adopted for prescribing the value of the hour angle of the vernal equinox that determines the instant designated as 0^h U.T.; and it is distinguished by being strictly in accordance with the measure of time defined by the rotation of the Earth. The formal measure of mean solar time is equivalent to the measure of time defined by the diurnal motion of the fictitious mean sun; but the actual *numerical value*, as obtained in practice from the diurnal motion of the equinox and the right ascension of the mean sun, is not the exact equivalent of the traditional *geometric representation* of this measure.

Likewise, the mean solar day is not exactly the period of one diurnal circuit of the fictitious mean sun in hour angle, as it would be were there no variations in the rate of rotation. The actual amount of the motion of the mean sun in right ascension during the interval of time between consecutive Greenwich mean midnights is not invariably the same as the constant amount with which the tabular hour angles of the equinox that determine the instants of midnight are formally calculated. At the instants of 0^h U.T., the mean sun is at varying hour angles, depending on the accumulated variations of the amounts of its sidereal motion during successive mean solar days.

The mean solar day, when determined from observations of stars, and corrected for the variations of the meridian, is rigorously proportional to the period of rotation of the Earth; but the rate of motion of the mean sun in hour angle is in a slightly varying ratio to the rate of rotation of the Earth, and the hour angle increased by 12^h is not an exact measure of mean solar time. Strictly, in

the expression for the right ascension of the mean sun, T denotes Ephemeris Time; and therefore 0^h U.T. is the instant at which the equinox reaches an hour angle numerically equal to the value which the right ascension of the mean sun increased by 12^h has already reached at an instant ΔT earlier. The lower meridian transit of the mean sun occurs at U.T.= $0.00274 \Delta T$, when E.T.= $1.00274 \Delta T$.

The observation of meridian transits of stars is the only practicable means of making, with the necessary rapidity and precision, the daily determinations of time by observation that are essential for practical purposes; and Universal Time is therefore an indispensable standard. Moreover, it is important as a means of determining the variations in the rotation of the Earth; and it is nearly enough uniform for most practical purposes. Ephemeris Time has been adopted as the standard for precise timekeeping, for physical measurements of high precision, and for accurate astronomical computations and theoretical investigations; but Universal Time is the basis of civil timekeeping, and is the standard in astronomical observation and in the practical applications of astronomy. In ephemerides intended only for facilitating astronomical observations, or for navigation or surveying, the argument is Universal Time.

In practice, in determining time, the inequalities that are due to variations of the vertical may be neglected, as they are too small in comparison with errors of observation to be significant except in an analysis of a long series of observations; but because of the high accuracy that has been reached in timekeeping, the inequalities due to the polar motion and to the annual variation in the rate of rotation of the Earth have become of practical importance. Beginning with 1956, in accordance with resolutions of the International Astronomical Union, determinations of Universal Time have been corrected for the annual variation in the rate of rotation, and for the variation in the position of the meridian due to the motion of the geographic poles.

Previous to 1925, mean solar time was reckoned from noon in astronomical practice. The mean solar day beginning at noon, 12 hours *after* the midnight at the beginning of the same civil date, was known as the Astronomical Day. Mean solar time reckoned from mean noon on the meridian of Greenwich was designated Greenwich Mean Time; reckoned from mean noon on a local meridian, local mean time. Beginning with the volumes for 1925, Universal Time was introduced in the national ephemerides under various names, a discontinuity of 12 hours being made in the arguments, so that December 31.5 in the volumes for 1924 designated the same instant as January 1.0 in the volumes for 1925. In the *British Nautical Almanac* the designation Greenwich Mean Time was still used for the new reckoning, together with local mean time where appropriate, whereas in the *American Ephemeris and Nautical Almanac* the designation Greenwich Civil Time was adopted, together with local civil time. This confusion in terminology was finally removed by dropping both designations and substituting Universal Time; it is, however, now called Greenwich Mean Time in the navigational publications of English-speaking countries. Care is necessary to avoid confusion; to distinguish the two reckonings that have both been called Greenwich Mean Time, the desig-

nation Greenwich Mean Astronomical Time should be used in referring to dates before 1925 when the time then known as Greenwich Mean Time is intended, and for dates in and after 1925 the reckoning from midnight should be exclusively used.

In the ephemerides, the hours of the mean solar day are counted from 0 to 24. As ordinarily used in civil life, they are counted from 0 to 12 in two series; the first series, designated A. M., extends from midnight to noon, and the second, designated P. M., from noon to midnight.

On any particular meridian of longitude, the local time, either solar or sidereal, is more advanced than at the same instant on any meridian farther west, and less advanced than on any meridian farther east; the difference amounts to one hour for each 15° difference in longitude. For civil purposes, however, clocks are customarily regulated to the same time throughout an entire zone of longitude about 15° wide; in particular, the United States is divided into four time zones, and the clock time kept throughout each zone is the local mean solar time of a selected standard meridian near the middle of the zone. Time in this system is known as Standard Time. The Standard Time throughout the British Isles is Universal Time. It is now common practice in many localities to advance the clock time during part of the year; this advanced time is known in the United States as Daylight Saving Time, and in the United Kingdom as Summer Time.

The extension of the system of Standard Time completely over the Earth is known as Zone Time. The standard meridians of the international time zones are 15° apart, beginning with the Greenwich meridian; and each zone is designated by the number of hours to be added algebraically to the Zone Time in order to obtain Universal Time. For example the Eastern Standard Time zone is Zone $+5^h$. Zone $+12^h$ and Zone -12^h each extends only to the International Date Line, which is everywhere along or near the 180th meridian; when the Date Line is crossed from east to west, the time is advanced by exactly 24 hours, i. e., the date abruptly increases by one day, with an additional change at places where the Date Line coincides with a time zone boundary.

Calendar (*pages 1-3*)

Over extended intervals, civil time is ordinarily reckoned according to conventional calendar years and adopted historical eras; in constructing and regulating civil calendars, and fixing ecclesiastical calendars, a number of auxiliary cycles and periods are used. The principal chronological eras and cycles are listed on page 1; and the Gregorian calendar for the current year is given on pages 2-3.

To facilitate chronological reckoning for many purposes, the astronomical days, beginning at Greenwich noon, are numbered consecutively, from an epoch sufficiently far in the past to precede the historical period; the number which denotes a day in this continuous count is the Julian Day Number. The Julian Day reckoning begins with Julian Day Number 0 for January 1, 4713 B.C., Julian proleptic calendar; the Julian Day Number therefore denotes the length of time that has elapsed, at Greenwich noon at the beginning of the

astronomical day, since this epoch. The Julian Day Numbers for the current year are given in the calendar on pages 2-3; from Table I they may be found for other years up to A.D. 2300, and it is readily apparent how this table may be extended over any interval.

Dates expressed in Julian Days and fractions of a day represent time elapsed at the instant. In several of the ephemerides in this volume, the arguments are designated by the Julian Dates in addition to the Gregorian calendar dates. On pages where the argument is Ephemeris Time, the Julian Date, like the calendar date, refers to ephemeris days; but the Julian Day begins at 12^h E.T., the calendar day at 0^h E.T. The terminology *Julian Ephemeris Date* may be used to distinguish the Julian Date with the day beginning at 12^h E.T. instead of at 12^h U.T. (Greenwich Mean Noon), where it is essential to avoid ambiguity, as in dating orbital elements, or in formulae for light curves of variable stars, where the time must be given to a large number of decimals of a day.

The period of one complete circuit of the fictitious mean sun in right ascension, beginning at the instant when the right ascension is 18^h 40^m, is known as the Besselian solar year, and is an advantageous unit of time for some astronomical purposes. In 1960, the beginning of the Besselian year is January 1st 345 Ephemeris Time; this instant is denoted by the notation 1960.0, and is given at the foot of each page of the calendar. Because of the secular excess of the right ascension of the fictitious mean sun over the mean longitude of the Sun, the Besselian year is shorter than the tropical year by the amount 0^h 148 *T*, where *T* denotes the time in centuries after 1900.

Phenomena (pages 4-9)

The principal configurations of the Sun, Moon, and planets with one another during the year, and other phenomena of general interest, are listed on these pages.

The *Diary* on pages 5-7 contains, in chronological order with times to the nearest hour: the geocentric phenomena for which only the dates are given on page 4; the occultations of the four bright stars *Aldebaran*, *Regulus*, *Spica*, and *Antares*, and of the planets visible to the unaided eye, for which at the top of page 5 another table is given that includes the area of visibility, the tabular times being for geocentric conjunction in right ascension; and the dates of the eclipses and transits that occur during the year, for which the areas of visibility are indicated at the bottom of page 4. In addition, the *Diary* includes the phases of the Moon, and apogee and perigee of the Moon; the closest approach of Mars to the Earth, when the geocentric distance passes through a minimum; geocentric conjunctions in apparent right ascension of the planets with the Moon, with one another, and with the bright stars *Aldebaran*, *Regulus*, *Spica*, and *Antares*, except when these phenomena occur within 24 hours of New Moon or within 10° of the Sun; and the geocentric phenomena of Ceres, Pallas, Juno, and Vesta, for which the dates alone are given at the bottom of page 8. The magnitudes and elongations from the Sun on every fifth day for

the inferior planets and every tenth day for the superior planets, and approximate magnitudes of the minor planets Ceres, Pallas, Juno, and Vesta at 40-day intervals, are tabulated on pages 8-9.

The geocentric phenomena differ from the actually observed configurations by the effects of the geocentric parallax at the place of observation, which for configurations with the Moon may be quite large. The tabular times for the stationary points of the planets are the instants at which the planet is stationary in *apparent* geocentric right ascension; but for the configurations of the planets with the Sun, the tabular times are for the *geometric* configurations. The times of conjunction and opposition are, respectively, the instants when the geocentric longitude of the planet differs by 0° and 180° from the geocentric longitude of the Sun. From inferior conjunction to superior conjunction of Mercury or Venus, or from conjunction to opposition of a superior planet, the elongation from the Sun is west; from superior to inferior conjunction, or from opposition to conjunction, the elongation is east. Because of the difference in latitude, the elongations do not in general pass through 0° or 180° as they change from west to east or from east to west. The tabular times of the greatest elongations of Mercury and Venus are the instants when the true geocentric angular distance from the Sun is a maximum.

The times of the equinoxes and solstices, which on page 4 are given to the nearest minute of Universal Time, are the instants when the apparent longitude of the Sun is a multiple of 90° .

The times given for the greatest brilliancy of Venus are the instants at which the value of the expression

$$\frac{(r + \Delta - R)(r + \Delta + R)}{r^3 \Delta^3}$$

is a maximum, where r and R denote, respectively, the heliocentric distances of Venus and the Earth, and Δ is the geocentric distance of Venus.

The heliocentric phenomena for which dates are given on page 4 are the perihelion and aphelion, the passages through the nodes on the ecliptic, and the greatest north and south heliocentric latitudes, in the actual disturbed motion. Because of perturbations, the dates are not in general the same as the dates that would be obtained from the elements of the mean orbit; the date on which the radius vector is a minimum may differ considerably from the date on which the heliocentric longitude of the planet is equal to the longitude of the perihelion of the mean orbit, and similarly the heliocentric longitude of the planet when its heliocentric latitude becomes zero may differ from the longitude of the mean node. At the ascending node, the planet passes through the plane of the ecliptic from south to north, and the heliocentric latitude vanishes in changing from negative to positive; at the descending node, the latitude changes from positive to negative as the planet passes through the plane of the ecliptic from north to south.

Universal and Sidereal Times (*pages 10-17*)

The sidereal time (Hour Angle of First Point of Aries) at 0^h Universal Time, and the Universal Time at 0^h sidereal time (Transit of First Point of Aries), which formerly were included in the ephemeris of the Sun, are tabulated both for the mean equinox of date, and for the true equinox with the short-period terms of nutation included. The definition of Universal Time was not changed when Ephemeris Time was formally introduced into astronomical practice. The practical method of determining Universal Time that was in established use before 1960 was retained; and the numerical reckoning of Universal Time was continued without discontinuity except for increased precision arising from the use of improved values of the nutation.

In the ephemeris of sidereal time at 0^h U.T., the argument is the calendar date and the equivalent Julian Date. In the ephemeris of Universal Time at 0^h sidereal time on each day, the argument is the Greenwich Sidereal Date, defined as the number of sidereal days, determined by the equinox of date, that have elapsed at Greenwich since the beginning of the sidereal day which was in progress at J.D. 0.0. The integral part of the Greenwich Sidereal Date is called the Greenwich Sidereal Day Number; it is a means of consecutively numbering the successive sidereal days beginning at the *transits* of the First Point of Aries, similar to the Julian Day reckoning of the successive mean solar days beginning at the instants of the *tabular hour angles* of the First Point of Aries. The Greenwich Sidereal Day is the number of sidereal days that have elapsed at 0^h Greenwich sidereal time since the Greenwich sidereal 0^h that immediately preceded J.D. 0.0; the zero day is the sidereal day that was in progress at the beginning of the Julian Era.

From these ephemerides for the meridian of Greenwich, the local mean time on any meridian of longitude may be calculated from the local sidereal time, or conversely. For this purpose, the longitude is expressed in time. The measure of longitude in arc may be converted to the equivalent measure in time by Table XII; the reverse transformation is obtained by Table XI.

The longitude expressed in time and reckoned positive westward is numerically the amount by which Universal Time is greater than the local mean solar time at the same instant. At the instant when the local mean time is 0^h, the longitude is therefore the measure of the interval of mean solar time that has elapsed at Greenwich since 0^h U.T.; and adding the equivalent measure of this mean solar interval in units of sidereal time to the Greenwich sidereal time at 0^h U.T. gives the sidereal time at Greenwich at the instant when the mean solar time on the *local* meridian is 0^h. Like the mean solar times, the Greenwich sidereal time is greater than the local sidereal time at the *same* instant by the amount of the longitude; and therefore the *local* sidereal time at 0^h local mean solar time is obtained directly by adding to the tabular Greenwich sidereal time at the *previous* instant of 0^h U.T. the same *correction* as required to convert the mean solar interval measured by the longitude into an equivalent sidereal interval. This reduction may either be taken from Table IX, or obtained by means of the hourly variation +9^s8565.

Similarly, the Universal Time of Greenwich sidereal 0^h may be reduced to the local mean solar time of 0^h local sidereal time at any longitude by applying the correction from Table VIII, or by means of the hourly variation -9^s8296.

Conversion of sidereal time to mean solar time

On 1960 July 7, at approximately 4^h local mean solar time, in longitude 85° 15' west (+ 5^h 41^m), the observed apparent sidereal time is 23^h 04^m 56^s.569. The Universal Time at this instant is approximately 10^h; the equation of the equinoxes is therefore -0^s175, and subtracting this amount from the observed sidereal time gives the local mean sidereal time.

	h	m	s
Greenwich mean sidereal time, 0 ^h U.T., July 7	18	59	50.725
Reduction for longitude (Table IX).			+ 56.018
Mean sidereal time, 0 ^h local mean solar time.	19	00	46.743
Local mean sidereal time at observation.	23	04	56.744
Sidereal interval since 0 ^h local mean solar time. . . .	4	04	10.001
Reduction to mean solar interval (Table VIII). . . .			- 40.001
Local mean solar time.	4	03	30.000

If the sidereal interval is less than 3^m 56^s.5, there are two mean solar times corresponding to the sidereal time, one a few minutes after the preceding 0^h, and the other a few minutes before the following 0^h, at a mean solar time interval of about 23^h 56^m 04^s. The approximate mean solar time always determines which one is to be taken. Any local sidereal time within an interval of less than 3^m 56^s.5 after 0^h local mean solar time will occur a second time on the same mean solar day; the subtraction of the local sidereal time of 0^h from either of these two sidereal times will give the same numerical result, but the actual interval for the second value is 24 sidereal hours greater.

The conversion of sidereal time to mean solar time may also be made by adding to the mean solar time of the *preceding* local sidereal 0^h the equivalent of the sidereal time in units of mean solar time.

Conversion of mean solar time to sidereal time

To convert mean solar time to mean sidereal time, add to the local mean sidereal time at 0^h the equivalent measure of the local mean solar time in sidereal units. To obtain the apparent sidereal time, add further the equation of the equinoxes, interpolated to the time. As an example, on 1960 July 7, in longitude 85° 15' west (+ 5^h 41^m), at 4^h 03^m 30^s local mean solar time, to determine the local sidereal time:

	h	m	s
Greenwich mean sidereal time, 0 ^h U.T., July 7	18	59	50.725
Reduction for longitude (Table IX).			+ 56.018
Local mean solar time	4	03	30.000
Reduction of local mean time to sidereal interval . .			+ 40.001
Local mean sidereal time	23	04	56.744
Equation of the equinoxes, July 7 ^d 406 U.T.			- 0.175
Local apparent sidereal time.	23	04	56.569

Sun, Moon, and Planets

In addition to providing the fundamental ephemerides for the preparation of navigational almanacs and other derived ephemerides, one of the principal purposes of this section is for the exact comparison of theory with observation, for the immediate purpose of more accurately determining astronomical constants and establishing the location of the equinox and equator among the stars, in order eventually to improve astronomical theories and tables. Except where otherwise stated, the tabular positions are *apparent* positions, i. e., the positions in which the Sun, Moon, and planets would actually be seen from the center of the Earth at the tabular times, displaced by planetary aberration and referred to the coordinate systems determined by the instantaneous equator, ecliptic, and equinox, with Ephemeris Time as the argument; the value used for the light-time at unit distance is $498^{\text{s}}38$, corresponding to the adopted constant of aberration. For comparison with photographic observations, *astrometric* positions are given for Pluto and the minor planets; for the latter they are included with the apparent positions. Ephemerides that are intended for theoretical purposes, where a fixed reference system is needed, are referred to the *fixed equinox* of a convenient epoch; and Tables III and IV are for facilitating reductions from one equinox to another.

The tabular quantities at instants other than the tabular times may be obtained by interpolation with the requisite order of differences. For this purpose, differences are included in many of the ephemerides; and formulae and tables for interpolation are given on pages 476–481.

The ephemerides are computed strictly from the tables to which references are made, and with the standard values that are stated for the fundamental constants. No corrections are applied to bring the tables into better accord with later observations; and in accordance with the resolutions of the International Astronomical Union, no change has been made in the conventionally adopted value of any fundamental constant that was used in the volumes immediately preceding 1960.

The adoption of Ephemeris Time does not require any change in previous procedures for computing the ephemerides; the tabular values are unaltered, but the terminology is revised in order that the tabular argument may be correctly designated as Ephemeris Time instead of Universal Time. The tabular coordinates for 1960 January 1 in the ephemerides of the Sun and the inner planets are therefore the same as for 1959 December 32 in the immediately preceding volume, except for the small differences due to improved values of the nutation and to the inclusion of short-period terms of nutation; but in the ephemerides of the outer planets and the Moon, the coordinates are not computed from the same tables as before 1960. Only the calculation of meridian transits, and the computation of transit ephemerides and of phenomena that depend upon hour angles, are affected by the formal recognition of Ephemeris Time; the precepts used before 1960 led actually to slightly inexact results.

Ephemeris Time is not adapted to the calculation of hour angles, since the value of ΔT is required for the determination of quantities that depend upon the rotation of the Earth. For facilitating practical calculations of

phenomena that depend upon hour angle and geographic location, an auxiliary reference meridian has therefore been introduced, known as the *ephemeris meridian*; it is defined as the meridian that is $1.002738\Delta T$ east of the actual geographic meridian of Greenwich on the surface of the Earth; its position in space is where the Greenwich meridian would be if the Earth had rotated uniformly. Longitude reckoned from the ephemeris meridian is distinguished by the term *ephemeris longitude*. Beginning with 1960, the time given in previous volumes for meridian transit at Greenwich is designated by the term *ephemeris transit*, which is the Ephemeris Time of transit across the ephemeris meridian. Interpolation to other meridians by using the *ephemeris longitude* as the interpolating factor gives the Ephemeris Time of local meridian transit; in forming first differences of the tabular ephemeris transits for this purpose, it must not be overlooked that the *day* is part of each tabular time.

When referred to the ephemeris meridian, phenomena depending on the rotation of the Earth may be calculated in terms of Ephemeris Time by methods formally the same as the procedures by which calculations referred to the Greenwich meridian are made in terms of Universal Time. The hour angle and the meridian transit of the vernal equinox, which determine the tabular sidereal time at 0^h Universal Time and the Universal Time at 0^h sidereal time, are referred to the actual *geographic* meridian of Greenwich. The numerical value formally obtained from the *same numerical relation* as used to compute the sidereal time at 0^h Universal Time, but with T reckoned expressly in Ephemeris Time, is the hour angle of the equinox referred to the *ephemeris meridian* at 0^h Ephemeris Time, and is called *ephemeris sidereal time*. Numerically, therefore, the tabular values of sidereal time at 0^h Universal Time are equally the values of ephemeris sidereal time at 0^h Ephemeris Time. Ephemeris transit occurs at the instant when the ephemeris sidereal time is equal to the right ascension.

Until ΔT is known, local hour angles referred to a *geographic* meridian cannot be calculated, but the ephemeris longitude where the actual local hour angle has any particular value may be determined entirely in terms of Ephemeris Time; and beginning with 1960, this procedure is followed in predictions of the general circumstances of eclipses. As soon as ΔT becomes known, the longitudes may be referred to the Greenwich meridian, and the Universal Times when the hour angle has the given values at these geographic longitudes may be determined.

For the computation of ephemerides with Universal Time as the argument, the value of ΔT is specifically required. Since ΔT depends primarily upon the *irregular* variations in the rate of rotation of the Earth, it cannot be determined in advance with certainty and exactness, or incorporated in the tables, but must be separately applied as determined from time to time by actual observation. Since ephemerides must be computed several years in advance, those that have the argument Universal Time are necessarily based upon an extrapolated value of ΔT . However, the uncertainty of the extrapolation, over the relatively short intervals necessary, is within the order of accuracy to which these ephemerides are calculated; in practice, to the degree of precision needed,

the ephemerides are for the most part unchanged by a transformation of the argument from Ephemeris Time to Universal Time.

Values of ΔT as determined from discussions of observations are tabulated on page viii, together with estimated values for several later years.

The method of converting an ephemeris from Ephemeris Time to Universal Time depends upon whether hour angles are involved in the computation of the tabular quantities. When the tabular values are independent of the rotation of the Earth, an ephemeris for 0^h Ephemeris Time may be converted to an ephemeris for 0^h Universal Time by interpolating the tabular values to an interval ΔT after 0^h Ephemeris Time; if second differences are negligible, the interpolated values are obtained by adding algebraically to each of the tabular values for 0^h Ephemeris Time the correction $\frac{\Delta T}{h} \delta_{1/2}$, where h is the tabular interval and $\delta_{1/2}$ denotes the first difference.

The Universal Time of transit of the Moon or a planet across the meridian of Greenwich may be found by subtracting ΔT from the Ephemeris Time of Greenwich transit that is obtained by interpolating the ephemeris transit from the geographic longitude of the ephemeris meridian, 1.002738 ΔT east, to longitude 0°. The ephemeris transit is the time on the Greenwich meridian at the instant of transit across the ephemeris meridian; the Greenwich transit follows ephemeris transit at an interval which to a first approximation exceeds ΔT by the time equivalent of the motion in right ascension during the interval ΔT . The Universal Time of Greenwich transit is therefore algebraically greater than the tabular ephemeris transit by approximately the amount $\frac{\Delta T}{h} \delta_{1/2} \alpha$.

The Greenwich transit of the Sun is determined from the equation of time which is tabulated in the ephemeris of the Sun; the calculation is given in the explanation of the equation of time.

Fundamental Units and Astronomical Constants

Time, Mass, and Length

The fundamental epoch from which Ephemeris Time is reckoned is the epoch that NEWCOMB designated as 1900 January 0, Greenwich Mean Noon, but which actually is 1900 January 0^d 12^h E.T.; the instant to which this designation is assigned is the instant near the beginning of the calendar year A. D. 1900 when the geometric mean longitude of the Sun referred to the mean equinox of date was 279° 41' 48".04. Ephemeris Time is the measure of time in which NEWCOMB's *Tables of the Sun* agree with observation.

The primary unit of Ephemeris Time is the tropical year, defined by the mean motion of the Sun in longitude at the epoch 1900 January 0^d 12^h E.T.; its length in ephemeris days is determined by the coefficient of T in NEWCOMB's expression for the geometric mean longitude of the Sun, L , referred to the mean equinox of date, given among the elements of the Sun. The *ephemeris second* is defined as 1/31556925.9747 of the tropical year for 1900 January 0^d 12^h E.T.; it has been formally adopted as the fundamental invariable unit of time by the Comité International des Poids et Mesures. The ephemeris day is 86400

ephemeris seconds. The former fundamental unit of time was the mean solar second, defined as $1/86400$ of the mean solar day.

In the astronomical system of measures, the usual unit of time is the ephemeris day. The fundamental unit of mass is the mass of the Sun. The unit of length is the astronomical unit, defined as the unit of distance in terms of which, in KEPLER's Third Law $n^2 a^3 = k^2 (1 + m)$, the semimajor axis a of an elliptic orbit must be expressed in order that the numerical value of the Gaussian constant k may be exactly 0.01720209895 when the unit of time is the ephemeris day (*Trans. Int. Astr. Union*, vol. VI, 1939, pages 20, 336, 357); in astronomical units, the mean distance of the Earth from the Sun, calculated by KEPLER's Law from the observed mean motion n and adopted mass m , is 1.0000 0003 (NEWCOMB).

Constants

Gaussian Constant of Gravitation $k = 0.01720\ 20989\ 50000$
 $= 3548''.18760\ 69651$ (Int. Astr. Union)

Solar Parallax	8''.80	} Paris Conference, 1896
Constant of Nutation	9.21	
Constant of Aberration	20.47	

Velocity of light 299 860 km/sec = 186 324 statute miles/sec (NEWCOMB and MICHELSON, *Astr. Pap. Amer. Eph.*, II, 202, 1891)

Equation of light

From constant of aberration. 498°38

From velocity of light and solar parallax 498°58

International Ellipsoid of Reference (Int. Union of Geodesy and Geophysics)

*Flattening $f = 1/297 = 0.003\ 367\ 003\ 367\ 003\ 367$

*Equatorial Radius $a = 6378\ 388\ \text{m}$

Polar Radius $a(1 - f) = 6356\ 911.946\ \text{m}$

Square of eccentricity $e^2 = 0.006\ 722\ 670\ 022\ 333\ 322$

Reduction from geodetic latitude ϕ to geocentric latitude ϕ'

$$\phi' - \phi = -11' 35''.6635 \sin 2\phi + 1''.1731 \sin 4\phi - 0''.0026 \sin 6\phi$$

Radius vector

$$\rho = a(0.998\ 320\ 047 + 0.001\ 683\ 494 \cos 2\phi - 0.000\ 003\ 549 \cos 4\phi + 0.000\ 000\ 008 \cos 6\phi)$$

One degree of latitude (m)

$$111\ 136.54 - 562.21 \cos 2\phi + 1.18 \cos 4\phi \quad (\phi = \text{mid-latitude of arc})$$

One degree of longitude (m)

$$111\ 417.66 \cos \phi - 93.90 \cos 3\phi + 0.12 \cos 5\phi$$

*Normal Gravity (cm/sec²)

$$g = 978.0490 (1 + 0.0052\ 884 \sin^2 \phi - 0.0000\ 059 \sin^2 2\phi)$$

Free-air gravity correction, cm/sec², at an elevation (in m) of H

$$- (0.0003\ 0855 + 0.0000\ 0022 \cos 2\phi) H + 0.0000\ 72 (H/1000)^2$$

Length of seconds pendulum (m)

$$0.9935\ 882 - 0.0026\ 203 \cos 2\phi + 0.0000\ 029 \cos 4\phi$$

*Adopted values, from which other quantities are derived.

Geocentric coordinates referred to the International Ellipsoid may be calculated from the geographic coordinates by means of Table VII and the formulae

$$\begin{aligned}\rho \sin \phi' &= (S+H) \sin \phi, \\ \rho \cos \phi' &= (C+H) \cos \phi,\end{aligned}$$

where S and C are taken from the table, and H is the altitude above sea-level in units of the equatorial radius of the Earth; the value of H is obtained by multiplying the altitude (in m) by $0.1567\,794 \times 10^{-6}$ (or the altitude in feet by $0.0477\,865 \times 10^{-6}$).

Annual rates of precession (NEWCOMB, *Astr. Pap. Amer. Eph.*, VIII, 73, 1897)

General precession	$p = 50''.2564 + 0''.0222\,T$
Planetary precession	$\lambda' = 0''.1247 - 0''.0188\,T$
Lunisolar precession	$\psi = 50''.3708 + 0''.0050\,T$
Precession in right ascension	$m = 3''.07234 + 0''.00186\,T$
Precession in declination	$n = 20''.0468 - 0''.0085\,T$

The time T is measured in tropical centuries from 1900.0. The values of p , m , and n at the beginning of the Besselian solar year are given on page 50.

These *rates* of the precessional motions at a particular epoch must be carefully distinguished from the accumulated *amounts* of the motions over an extended interval of time, and the consequent displacements of the coordinate systems which the precessional motions produce. The amount of the precession in right ascension during the interval of time from t_0 to t is $\zeta_0 + z$, where $90^\circ - \zeta_0$ is the right ascension of the ascending node of the mean equator at time t on the mean equator of t_0 reckoned from the mean equinox of t_0 , and $90^\circ + z$ is the right ascension of the node reckoned from the mean equinox of t ; the amount of the precession in declination is the inclination θ of the mean equator at time t to the mean equator of t_0 . For $t_0 = 1950.0$, with the interval of time T from this epoch measured in tropical centuries,

$$\begin{aligned}\zeta_0 &= +2304''.948\,T + 0''.302\,T^2 + 0''.0179\,T^3, \\ z &= +2304''.948\,T + 1''.093\,T^2 + 0''.0192\,T^3, \\ \theta &= +2004''.255\,T - 0''.426\,T^2 - 0''.0416\,T^3.\end{aligned}$$

Interchanging t_0 with t replaces ζ_0 by $-z$, and z by $-\zeta_0$, and changes the sign of θ .

On page 50, the numerical values are given for these precessional displacements of the mean equator and mean equinox during the interval between 1950.0 and the beginning of the current year; and Table III contains values for other intervals. Over a short interval, the values of $\zeta_0 + z$ and θ may be obtained from the rates m and n of the precessions at the *midpoint of the interval*, by the formulae

$$M = m(t_0 - t), \quad N = n(t_0 - t).$$

Similarly, the amounts of the general precession in longitude a , and rotation of the ecliptic b , may be calculated from the rate of precession p , and speed of rotation of the ecliptic π , at the midpoint of the interval, by

$$a = p(t_0 - t), \quad b = \pi(t_0 - t).$$

The numerical values of these quantities for the interval between 1950.0 and the current year, and of

$$c = 180^\circ - \Pi + \frac{1}{2}a$$

where Π is the longitude of the axis of rotation of the ecliptic at the midpoint of the interval, are also given on page 50, with formulae for calculating the corresponding precessional variations of equatorial and ecliptic coordinates, and of the ecliptic elements Ω , i , ω , of an orbit. Expressions for calculating π and Π at any date are given among the elements of the Sun.

Nutation

The formulae adopted for computing the nutation in longitude and obliquity are given in the joint supplement to the *American Ephemeris* and the *British Nautical Almanac* entitled *Improved Lunar Ephemeris 1952-1959*, pages ix-x (1954). They are obtained by retaining all terms with coefficients as great as 0".0002 from the expressions developed in *Astr. Pap. Amer. Eph.*, vol. XV, Part I, page 153, 1953, and reproduced in *Astr. Jour.*, 58, 2, 1953.

Beginning with 1960, the effects of short-period terms, defined as terms with periods of less than 100 days, are fully included in the ephemerides of the Sun, Moon, and planets.

Sun (pages 18-50)

The ephemerides of the Sun are derived from the geometric longitude referred to the mean equinox of date, the latitude referred to the ecliptic of date, the radius vector, and the mean obliquity of date, that are taken from NEWCOMB'S *Tables of the Sun*, *Astr. Pap. Amer. Eph.*, vol. VI, Part I, 1895. The mean orbital elements on which these tables are based, with T denoting the time measured in Julian centuries of 36525 ephemeris days from the epoch, and d the time in ephemeris days, are:

$$\text{Epoch 1900 January 0.5 E.T.} = \text{J.D. 241 5020.0}$$

Geometric mean longitude, mean equinox of date

$$\begin{aligned} L &= 279^\circ 41' 48".04 + 1296 \ 02768".13 T + 1".089 T^2 \\ &= 279^\circ 69668 + 0^\circ 98564 \ 73354 d + 0^\circ 000303 T^2 \end{aligned}$$

Mean longitude of perigee, mean equinox of date

$$\begin{aligned} \Gamma &= 281^\circ 13' 15".0 + 6189".03 T + 1".63 T^2 + 0".012 T^3 \\ &= 281^\circ 22083 + 0^\circ 00004 \ 70684 d + 0^\circ 000453 T^2 + 0^\circ 000003 T^3 \end{aligned}$$

Mean anomaly, $L - \Gamma$

$$\begin{aligned} g &= 358^\circ 28' 33".0 + 1295 \ 96579".10 T - 0".54 T^2 - 0".012 T^3 \\ &= 358^\circ 47583 + 0^\circ 98560 \ 02670 d - 0^\circ 000150 T^2 - 0^\circ 000003 T^3 \end{aligned}$$

Eccentricity

$$e = 0.01675 \ 104 - 0.00004 \ 180 T - 0.00000 \ 0126 T^2$$

The principal related auxiliary constants are:

Mean obliquity of the ecliptic

$$\begin{aligned} \epsilon &= 23^\circ 27' 08".26 - 46".845 T - 0".0059 T^2 + 0".00181 T^3 \\ &= 23^\circ 452294 - 0^\circ 01301 \ 25 T - 0^\circ 00000 \ 164 T^2 + 0^\circ 00000 \ 0503 T^3 \end{aligned}$$

Annual rate of rotation of ecliptic	$\pi = 0''.4711 - 0''.0007 T$
Longitude of axis of rotation	$\Pi = 173^\circ 57'.06 + 54'.77 T$
Length of the year	
Tropical	$365^d 2421 9879 - 0^s 0000 0614 T$ $365^d 05^h 48^m 46^s 0 - 0^s 530 T$
Sidereal	$365^d 2563 6042 + 0^s 0000 0011 T$ $365^d 06^h 09^m 09^s 5 + 0^s 01 T$
Anomalistic	$365^d 2596 4134 + 0^s 0000 0304 T$ $365^d 06^h 13^m 53^s 0 + 0^s 26 T$
Eclipse	$346^d 6200 31 + 0^s 0000 32 T$ $346^d 14^h 52^m 50^s 7 + 2^s 8 T$

The longitude of the axis of rotation of the ecliptic is for the extremity that is at the ascending node of the instantaneous position of the ecliptic on the immediately preceding position; and it is referred to the mean equinox of date. The position of the ecliptic in terms of its inclination π_1 and node Π_1 on the fixed ecliptic of the epoch is represented by

$$\begin{aligned}\pi_1 \sin \Pi_1 &= +4''.964 T + 0''.1939 T^2 - 0''.00019 T^3, \\ \pi_1 \cos \Pi_1 &= -46''.845 T + 0''.0545 T^2 + 0''.00035 T^3.\end{aligned}$$

The values of L and g for every tenth day, the values of Γ and e at the beginning of the calendar year, and of π , Π , and ϵ and the trigonometric functions of ϵ for the beginning of the Besselian year, are given on page 50.

The geocentric spherical coordinates of the Sun are tabulated in the ephemeris on pages 18–33; and the geocentric equatorial rectangular coordinates on pages 34–49.

The tabular longitude is the geometric longitude referred to the mean equinox of the beginning of the Besselian year; it may be reduced to the fixed mean equinox of 1950.0 by applying the correction given in the footnote. The values of the latitude referred both to the ecliptic of the beginning of the year and to the fixed ecliptic of 1950.0 are tabulated, in addition to the latitude referred to the ecliptic of date.

The precession in longitude is the amount of the precessional displacement of the equinox along the ecliptic since the beginning of the Besselian year. Adding it to the tabular longitude gives the geometric longitude referred to the mean equinox of date, which may be further reduced to the true equinox of date by adding the nutation in longitude. The precession and nutation in longitude are tabulated to one more decimal than in volumes before 1960; and the nutation includes short-period terms.

The reduction to apparent longitude is the sum of the nutation in longitude at date and the precession from the beginning of the year to date, diminished by aberration which is calculated by dividing $20''.47$ by the radius vector.

The horizontal parallax is the angle subtended at the Sun by the equatorial radius of the Earth; the tabular values are calculated by dividing $8''.80$ by the radius vector.

The apparent right ascension and declination are referred to the true equinox and equator of date, and are affected by aberration. They are calculated from the geometric longitude, the latitude referred to the ecliptic of date, and the tabular obliquity of date, which is the sum of the mean obliquity and the nutation in obliquity inclusive of short-period terms; they are corrected for aberration by antedating for the light-time. The value of the radius vector is geometric, not affected by aberration.

The tabular semidiameter includes an allowance for irradiation, and is obtained by dividing an enhanced value of the semidiameter at unit distance by the radius vector, although actually the irradiation does not depend upon the distance; the value adopted for the enhanced semidiameter at unit distance is $16' 01''.18$, the same as in the *Nautical Almanac* for years immediately preceding 1960, but different from the value used before 1960 in the *American Ephemeris* because of a different allowance for irradiation. In the calculation of eclipses, the adopted semidiameter at unit distance is $15' 59''.63$ (AUWERS, *Astronomische Nachrichten*, 3068, 367, 1891), the same as in both the *Nautical Almanac* and the *American Ephemeris* before 1960.

The equation of time, apparent minus mean, is the reduction to be applied to mean solar time in order to obtain the measure of apparent solar time. The tabular value at 0^h E.T. is obtained by subtracting the apparent right ascension of the Sun at 0^h E.T. from the apparent sidereal time of 0^h U.T. increased by 12^h; the values for 1960 January 0 and January 1 are therefore numerically the same as the tabular values for December 31 and December 32 in the volume for 1959. Since the sidereal time at 0^h U.T. is equal numerically to the right ascension of the fictitious mean sun at 0^h E.T. increased by 12^h, the equation of time determined by this method of calculation is the difference between the right ascensions of the mean sun and the actual Sun, the same as in the volumes before 1960; but the tabular values are for 0^h E.T., not 0^h U.T. as formerly but inexactly designated.

At every instant, the equation of time is rigorously the value of the hour angle of the Sun minus the hour angle of the fictitious mean sun. However, it does not conform exactly to the traditional interpretation as the hour angle of the Sun at local mean noon, because at the instant when the hour angle of the Sun is equal to the equation of time and the mean sun is consequently on the meridian, the local mean time is not precisely 12^h, but $12^h + 0.002738 \Delta T$. Likewise, the measure of apparent solar time formally defined by the tabulated equation of time is not precisely the hour angle of the Sun increased by 12^h; and the Sun does not transit the meridian exactly at local apparent noon.

In terms of the Greenwich hour angle of the Sun H , the Greenwich apparent solar time at any instant is

$$12^h + H + 0.002738 \Delta T;$$

this measure has no discontinuity from 1959 to 1960.

At Greenwich mean noon, 12^h U.T., the hour angle of the Sun is

$$H = E - 0.002738 \Delta T,$$

where E denotes the equation of time; and at Greenwich apparent noon, 12^h apparent solar time, the hour angle of the Sun is

$$H = -0.002738 \Delta T.$$

At Greenwich transit of the Sun, when the hour angle of the Sun is zero,

$$\text{U.T.} = 12^h - E + 0.002738 \Delta T;$$

and the apparent solar time is $12^h + 0.002738 \Delta T$.

The geocentric rectangular coordinates of the Sun, referred to the mean equator and equinox of the beginning of the year as the fundamental plane and point of reference, are tabulated on pages 34–41, with first and second differences for interpolation; and the rectangular coordinates referred to the mean equator and equinox of 1950.0 are given on pages 42–49. The positive X -axis is directed toward the equinox, the Y -axis toward the point on the equator at right ascension 6^h , and the Z -axis toward the north pole of the equator.

The dates for which the integral part of the Julian Day Number is divisible by 10 are indicated by bold-face type. These are the standard 10-day ephemeris dates recommended by the International Astronomical Union.

Moon (pages 51–159)

Beginning with the volume for 1960, the lunar ephemeris is calculated directly from BROWN's theory instead of from his *Tables of the Motion of the Moon*; but in order to obtain a strictly gravitational ephemeris expressed in the same measure of time as defined by NEWCOMB's *Tables of the Sun*, the orbital elements upon which BROWN's tables are based were amended by removing the empirical term and by applying to the mean longitude the correction

$$-8''.72 - 26''.74 T - 11''.22 T^2,$$

where T is measured in Julian centuries from 1900 January 0.5 E.T. = J.D. 2415020.0. A description of the method of calculating the ephemeris, and a comparison of the positions with tabular positions from BROWN's tables, are included in the *Improved Lunar Ephemeris 1952–1959*, which was issued in 1954 to make the amended ephemeris available before 1960.

Denoting by d the number of ephemeris days from the epoch, the fundamental orbital constants are

$$\begin{aligned} \zeta &= 270^\circ 26' 02''.99 + 1336' 307^\circ 52' 59''.31 T - 4''.08 T^2 + 0''.0068 T^3 \\ &= 270^\circ.434164 + 13^\circ.17639 \ 65268 d - 0^\circ.001133 T^2 + 0^\circ.0000019 T^3, \end{aligned}$$

$$\begin{aligned} I' &= 334^\circ 19' 46''.40 + 11' 109^\circ 02' 02''.52 T - 37''.17 T^2 - 0''.045 T^3 \\ &= 334^\circ.329556 + 0^\circ.11140 \ 40803 d - 0^\circ.010325 T^2 - 0^\circ.000012 T^3, \end{aligned}$$

$$\begin{aligned} \Omega &= 259^\circ 10' 59''.79 - 5' 134^\circ 08' 31''.23 T + 7''.48 T^2 + 0''.008 T^3 \\ &= 259^\circ.183275 - 0^\circ.05295 \ 39222 d + 0^\circ.002078 T^2 + 0^\circ.000002 T^3, \end{aligned}$$

$$e = 0.05490 \ 0489,$$

$$\gamma = 0.04488 \ 6967,$$

$$\text{constant of sine parallax, } 3422''.5400,$$

where γ is the sine of half the inclination to the ecliptic, e denotes the eccentricity, and

\mathcal{C} , the mean longitude of the Moon, measured in the ecliptic from the mean equinox of date to the mean ascending node of the lunar orbit, and then along the orbit;

Γ' , the mean longitude of the lunar perigee, measured in the ecliptic from the mean equinox of date to the mean ascending node of the lunar orbit, and then along the orbit;

Ω , the longitude of the mean ascending node of the lunar orbit on the ecliptic, measured from the mean equinox of date.

The equatorial horizontal parallax at distance 60.2665 equatorial radii of the Earth is $57' 02''.70$.

In the lunar theory, the adopted ratio of the mass of the Earth to the mass of the Moon is 81.53.

The mean elongation of the Moon from the Sun is

$$D = 350^\circ 44' 14''.95 + 1236' 307^\circ 06' 51''.18 T - 5''.17 T^2 + 0''.0068 T^3 \\ = 350^\circ 737486 + 12^\circ 19074 \ 91914 \ d - 0^\circ 001436 T^2 + 0^\circ 0000019 T^3.$$

The lengths of the months for the epoch 1900 are

	d		d	h	m	s
Synodic	29.530	589	29	12	44	02.9
Tropical	27.321	582	27	07	43	04.7
Sidereal	27.321	661	27	07	43	11.5
Anomalistic	27.554	551	27	13	18	33.2
Draconitic	27.212	220	27	05	05	35.8

The secular variations do not exceed a few hundredths of a second per century, and depend partly upon the variations in the rate of rotation of the Earth.

The values of Γ' , Ω , \mathcal{C} , and D for every tenth day are tabulated on page

51. This page also contains, for every tenth day, the values of

i , the inclination of the mean equator of the Moon to the true equator of the Earth,

Δ , the arc of the mean equator of the Moon from its ascending node on the true equator of the Earth to its ascending node on the ecliptic of date,

Ω' , the arc of the true equator of the Earth from the true equinox of date to the ascending node of the mean equator of the Moon,

calculated with HAYN's value of $1^\circ 32'.1$ for the inclination of the mean lunar equator to the ecliptic; the ascending node of the mean lunar equator on the ecliptic is at the descending node of the mean lunar orbit, $\Omega \pm 180^\circ$.

The coordinates of the Moon are tabulated to one more decimal than in volumes preceding 1960.

The longitude referred to the mean equinox of date, the latitude referred to the ecliptic of date, and the horizontal parallax are computed for every half-day from BROWN's theoretical expressions, with the corrections required for the amendment to the mean longitude. The apparent longitude and lati-

tude are obtained by adding the nutation in longitude and some residual effects of aberration not included in BROWN's expressions.

The semidiameter, s , is derived from the horizontal parallax, π , by the formula

$$s = 0''.079 + 0.272446 \pi,$$

the constants in which are based on NEWCOMB's value of $15' 32''.58$ for the semidiameter at mean distance (Researches on the Motion of the Moon, Part II, *Astr. Pap. Amer. Eph.*, Vol. IX, 39, 1912). No correction is made for irradiation.

The apparent right ascension and declination for each hour of Ephemeris Time (pages 68–159) are calculated for 0^h and 12^h from the apparent longitude, the apparent latitude, and the true obliquity of date; and for the other hours by interpolation.

Page 159 contains the phases of the Moon, and the times of apogee and perigee or greatest and least distances from the Earth. The times of New Moon, First Quarter, Full Moon and Last Quarter are the times at which the excess of the apparent longitude of the Moon over the apparent longitude of the Sun is 0° , 90° , 180° , and 270° , respectively.

The Principal Planets (pages 160–235)

Heliocentric ephemerides of the principal planets are given on pages 160–176, followed on pages 176–177 by the values of the orbital elements during the year. Geocentric ephemerides, calculated from the heliocentric coordinates of the planets and the geocentric coordinates of the Sun, are given on pages 178–235.

The ephemerides of the *inner planets* Mercury, Venus, and Mars are obtained from the same tables as for years immediately preceding 1960. The orbital longitudes and the heliocentric ecliptic longitudes referred to the mean equinox of date, the heliocentric latitudes referred to the ecliptic of date, and the radius vectors are taken from NEWCOMB's tables of these planets in *Astr. Pap. Amer. Eph.*, Vol. VI, Parts II, III, IV, 1895–1898; for Mars, the corrections derived by Ross, *Astr. Pap. Amer. Eph.*, Vol. IX, Part II, 1917, are applied. The elements of the mean orbits are tabulated on page 176. For Venus and Mars, the latitude referred to the mean orbit, due to periodic perturbations in latitude, is included in the heliocentric ephemerides.

The ephemerides of the *outer planets* Jupiter, Saturn, Uranus, Neptune, and Pluto, beginning with 1960, are computed from the heliocentric rectangular coordinates obtained by numerical integration in *Astr. Pap. Amer. Eph.*, Vol. XII, 1951. Perturbations by the inner planets, taken from *Astr. Pap. Amer. Eph.*, Vol. XIII, Part V, 1954, are included in the geocentric ephemerides, but are omitted from the heliocentric ephemerides, and from the heliocentric orbital elements tabulated on page 177; these elements are for the osculating orbits. The geocentric right ascensions and declinations of the outer planets are tabulated to one more decimal than for years preceding 1960.

In these tables and ephemerides, the values adopted for the masses of the planets, including atmospheres and satellites, are:

	Reciprocal Mass		Reciprocal Mass
Mercury . . .	6 000 000	Uranus	22 869
Venus	408 000	Neptune	
Earth	329 390	In tables of five outer planets . .	19 314
Mars	3 093 500	In tables of four inner planets . .	19 700
Jupiter . . .	1 047.355	Pluto	360 000
Saturn	3 501.6		

In the planetary theory, the adopted ratio of the mass of the Earth to the mass of the Moon is 81.45; and the ratio of the mass of the Sun to the mass of the Earth alone, 333 432.

In the geocentric ephemerides, the *apparent* right ascension and declination are referred to the true equator and equinox of date, inclusive of the short-period terms of nutation; and they have been corrected for planetary aberration by antedating for the light-time.

The *astrometric* positions of Pluto and the minor planets are obtained by adding the planetary aberration to the geometric ephemeris and then subtracting stellar aberration, calculated by the conventional formula which neglects the part depending on the longitude of the perihelion of the Earth. The *astrometric* ephemeris is therefore rigorously comparable with observations that are referred to catalogue mean places of comparison stars, it being only necessary to correct the observations for geocentric parallax.

The tabular true distance from the Earth is the actual geocentric distance at the tabular time, *not* at the instant when the light that reaches the observer at the tabular time left the planet.

The horizontal parallax is $8''.80$ divided by the geocentric distance. The tabular semidiameter is the value at unit distance divided by the geocentric distance; the adopted semidiameters at unit distance are:

Mercury	$3''.34$	LE VERRIER, <i>Liouville's Journal</i> , Tome VIII, 279, 1843.
Venus	$8''.41$	AUWERS, <i>Astronomische Nachrichten</i> 3214, page 361, 1894.
Mars.	$4''.68$	HARTWIG, <i>Publikation der Astronomischen Gesellschaft</i> , vol. XV, 77, 1879.
Jupiter:		
Equatorial	$98''.47$	SAMPSON, <i>Tables of the Four Great Satellites of Jupiter</i> , pages xvi, xxi, 1910.
Polar.	$91''.91$	
Saturn:		
Equatorial	$83''.33$	H. STRUVE, <i>Pub. de l'Obs. Central Nicolas</i> , Série II, vol. XI, 207, 1898.
Polar	$74''.57$	
Uranus	$34''.28$	Weighted mean of: BARNARD, <i>Astr. Jour.</i> , vol. XVI, 75, 1896; T. J. J. See, <i>Astronomische Nachrichten</i> 3768, page 399, 1902; WIRTZ, <i>Annalen der Kaiserlichen Universitäts-Sternwarte in Strassburg</i> , Band 4, Teil II, 285, 1912.
Neptune	$36''.56$	BARNARD, <i>Astr. Nachr.</i> 3760, 266, 1902.

Minor Planets (pages 236-265)

The ephemerides of Ceres, Pallas, Juno, and Vesta are computed from unpublished heliocentric rectangular coordinates calculated by PAUL HERGET by means of numerical integration with the Naval Ordnance Research Calculator (NORC). An adaptation of HANSEN's method was used, with a 10-day interval. The integrations were adjusted along the entire orbits to the previous integrations that were used for the ephemerides before 1960; a smooth join-on at 1960 was obtained by taking most of the equations of condition near this epoch. Differences from the previous orbits are attributable to accumulation of rounding errors in the former integrations. The largest discontinuity at 1960 is 0".07 for Vesta, which is smaller than the amounts that may be reached by the non-gravitational parts of the previous coordinates.

The ephemerides are in the same form as for Pluto, with the addition of the reductions from astrometric to apparent right ascension and declination. Daily positions are given for the periods during which the planet is more than about 40° from the Sun. Since accurate observations of the minor planets may lead to an improved value for the mass of the Moon, the dates on which the lunar inequality is a maximum in right ascension are indicated by an asterisk.

Stars

The star places that are given in this volume are limited to the mean places of the brighter stars at the beginning of the Besselian year, to an accuracy of 0".1 in right ascension and 1" in declination. However, the volume contains all the data necessary for the accurate reduction of precise star places from one epoch to another, or from mean place to apparent place.

Day Numbers (pages 266-287)

The Besselian Day Numbers and the Independent Day Numbers for calculating reductions from the mean place to the apparent place are given for 0^h Ephemeris Time on pages 266-281, to one more decimal than in volumes immediately preceding 1960; the sidereal time at 0^h Ephemeris Time, to the nearest tenth of an hour, is tabulated with these Day Numbers to assist in determining the interpolating factor for the time of meridian transit of a star. The Besselian Day Numbers at 0^h Greenwich sidereal time are tabulated on pages 282-285.

From these Day Numbers, the reduction for precession, nutation, and aberration is obtained to the first order. The additional Day Numbers necessary to determine the reduction to the second order are given on pages 286-287.

To avoid a second-order reduction as far as possible, the Day Numbers, beginning with 1960, are referred to the *nearest* beginning of a year, instead of always to the beginning of the current year. For any tabular date, τ denotes the fraction of a tropical year that has elapsed since the date to which the tabular values of the Day Numbers are referred; and the apparent place is obtained with these Day Numbers from the mean place at the beginning of either the *current* Besselian year or the *next following* year, according to the

tabular value of τ . By not extending the reduction over more than half a year, the second-order reduction and the error from neglecting it are kept as small as practicable.

The reductions to the second order are

$$\begin{aligned}\alpha &= \alpha_0 + Aa + Bb + Cc + Dd + E + J \tan^2 \delta \\ &= \alpha_0 + f + g \sin (G + \alpha_0) \tan \delta_0 + h \sin (H + \alpha_0) \sec \delta_0 + J \tan^2 \delta, \\ \delta &= \delta_0 + Aa' + Bb' + Cc' + Dd' + J' \tan \delta \\ &= \delta_0 + g \cos (G + \alpha_0) + h \cos (H + \alpha_0) \sin \delta_0 + i \cos \delta_0 + J' \tan \delta,\end{aligned}$$

where zero subscripts denote the mean place, and

$$\begin{aligned}a &= \frac{m}{n} + \sin \alpha_0 \tan \delta_0, & a' &= \cos \alpha_0, \\ b &= \cos \alpha_0 \tan \delta_0, & b' &= -\sin \alpha_0, \\ c &= \cos \alpha_0 \sec \delta_0, & c' &= \tan \epsilon \cos \delta_0 - \sin \alpha_0 \sin \delta_0, \\ d &= \sin \alpha_0 \sec \delta_0, & d' &= \cos \alpha_0 \sin \delta_0,\end{aligned}$$

which are known as the Besselian Star Constants; in the second-order terms, or in a reduction to only the first order, it is immaterial whether the mean or the apparent values of the coordinates are used in the right-hand members. Further reductions are also required for proper motion and for parallax, as far as they are known and of appreciable magnitude; and in the case of binary stars, a correction for orbital motion may be necessary. The tabular values of the Day Numbers A , B , C , D , g , h , i , are in seconds of arc; when used for reducing right ascension, either they or the star constants by which they are multiplied must be divided by 15 to express the reduction in seconds of time.

The Besselian Day Numbers A , B , and E , or the Independent Day Numbers f , g , and G , give the reduction for precession and nutation. Beginning with 1960, they are derived from the improved values of the nutation, including short-period terms; and A is redefined as the product of the former value by the precession in declination, n , in order to express it in seconds of arc. Before 1960, the star constants a and a' were defined as $a = m + n \sin \alpha_0 \tan \delta_0$, $a' = n \cos \alpha_0$. The short-period terms of nutation in longitude and obliquity, $d\psi$ and $d\epsilon$, respectively, and the Day Numbers f' , g' , G' , for obtaining the effects of these terms alone, are also tabulated on pages 266–281.

The Day Numbers C and D , or H , h , and i , give the reduction for aberration; beginning with 1960, they are derived from the actual disturbed velocity of the Earth referred to the center of mass of the solar system.

The Besselian Day Numbers are the most expeditious means of reduction when several apparent positions of the same star are required, or when the values of the Besselian star constants are already available; otherwise, the Independent Day Numbers are the more convenient.

Example

To illustrate the calculation of an apparent place for a date in any part of the year, by means of either the Besselian or the Independent Day Numbers, the apparent place of α Coronae Borealis for the upper transit at Greenwich on July 1 is obtained in the following example both by a reduction from the mean place at the beginning of the year, using the Besselian Day Numbers, and by a reduction from the mean place at the beginning of the next following year, using the Independent Day Numbers; for this date, the Day Numbers are given for both epochs in the ephemeris.

From Kopff's *Dritter Fundamentalkatalog des Berliner Astronomischen Jahrbuchs* (FK3), the mean place is:

	1960.0	1961.0
α_0	15 ^h 32 ^m 59 ^s .556	15 ^h 33 ^m 02 ^s .097
δ_0	+ 26° 50' 53".77	+ 26° 50' 41".69

The time of upper transit, to an accuracy sufficient for interpolating the Day Numbers, is $\alpha_0 - \text{S.T. } 0^{\text{h}} = \text{July } 1^{\text{d}}871$.

The Day Numbers including short-period terms, interpolated with second differences, and the star constants, are:

1960 July 1^d871

τ	+ 0.4998	τ	- 0.5002
A	+ 8".814	f	- 1 ^s .7223
B	+ 9".572	g	14".754
C	+ 3".262	G	9 ^h 18 ^m 12 ^s
D	- 20".148	h	20".411
E	- 0 ^s .0005	H	11 ^h 23 ^m 10 ^s
		i	+ 1".417
a	+ 1.8947	$G + \alpha_0$	0 ^h 51 ^m 14 ^s
b	- 0.3029	$H + \alpha_0$	2 56 12
c	- 0.6707		
d	- 0.8980		
a'	- 0.5984		
b'	+ 0.8012		
c'	+ 0.7488		
d'	- 0.2702		

The second-order Day Numbers are not required as their contribution is inappreciable. The annual proper motions are $\mu = + 0^{\text{s}}009$, $\mu' = - 0^{\text{s}}09$.

Besselian reduction from 1960.0

α_0	15 ^h 32 ^m 59 ^s .556	δ_0	+26° 50' 53".77
<i>Aa</i>	+ 1.1133	<i>Aa'</i>	— 5.274
<i>Bb</i>	— 0.1933	<i>Bb'</i>	+ 7.669
<i>Cc</i>	— 0.1459	<i>Cc'</i>	+ 2.443
<i>Dd</i>	+ 1.2062	<i>Dd'</i>	+ 5.444
<i>E</i>	— 0.0005		
$\tau\mu$	+ 0.0045	$\tau\mu'$	— 0.045
α	15 ^h 33 ^m 01 ^s .540	δ	+26° 51' 04".01

Reduction from 1961.0, with Independent Day Numbers

α_0	15 ^h 33 ^m 02 ^s .097	δ_0	+26° 50' 41".69
<i>f</i>	— 1.7223	$g \cos (G + \alpha_0)$	+14.387
$g \sin (G + \alpha_0) \tan \delta_0$	+ 0.1104	$h \cos (H + \alpha_0) \sin \delta_0$	+ 6.625
$h \sin (H + \alpha_0) \sec \delta_0$	+ 1.0604	$i \cos \delta_0$	+ 1.264
$\tau\mu$	— 0.0045	$\tau\mu'$	+ 0.045
α	15 ^h 33 ^m 01 ^s .541	δ	+26° 51' 04".01

Positions calculated by different methods may sometimes differ by a unit in the end figure.

Reductions for precession and nutation directly from the standard equinox of 1950.0 to the true equinox of date may be obtained with sufficient accuracy for a finding ephemeris of a comet or a minor planet by means of Table IV, in accordance with the formulae at the foot of the table. The tabular dates are the midnights following an integral Julian Date that is exactly divisible by 10, in accordance with the resolutions of the International Astronomical Union that the osculation epochs of elements of comets and minor planets should be Julian Dates with the integral part divisible by 400, and that ephemerides should be for 10-day intervals. Dates followed by an asterisk are the Julian Dates with integral part divisible by 40.

To facilitate the reduction of observations in which the differences of right ascension and declination between two celestial objects are measured, the differential aberration and the differential precession and nutation may be determined from Tables V and VI in accordance with the precepts given with the tables. With the position of a star reduced to the equinox of 1950.0, or to the equinox of the nearest beginning of a year, the coordinates of an object referred to the same equinox are obtained by adding to the coordinates of the star the observed differences in the sense "object minus star", and the differential aberration, precession, and nutation taken from these tables.

Mean Places of Stars (pages 288–298)

Mean places at the beginning of the Besselian year are tabulated for 1078 stars, including stars to a limiting magnitude 4.75 excepting 8 stars each within 30" of an included star; variable stars are in general included if the maximum is brighter than 4.7. The positions are taken from the Albany *General Cata-*

logue of 33342 Stars for the Epoch 1950, 1937. The stars are tabulated in the order of their mean right ascensions at the epoch 1950.0. In the name of the star, the three-letter abbreviations for constellation names recommended by the International Astronomical Union are used.

Disregarding proper motion, which is generally much less than a second of arc per year, the mean places at other epochs may be obtained by a reduction for precession alone. In particular, to obtain the mean place at the beginning of the next following year, which is required for calculating reductions from mean to apparent places with the tabular Day Numbers during the latter half of the current year, add to the tabular coordinates the reductions

$$\begin{aligned}\Delta\alpha &= m + n \sin \alpha \tan \delta, \\ \Delta\delta &= n \cos \alpha,\end{aligned}$$

where the values of m and n are taken from page 50. Formulae and constants for the reduction of right ascension and declination, and of longitude and latitude, for precession from the beginning of the current year to 1950.0 and in the reverse direction, are also given on page 50; and an extended tabulation of the equatorial precessional constants for other intervals is given in Table III.

Table III contains the reduction constants ζ_0 , z , and θ for rigorous trigonometric reductions of mean places to the beginning of the current year from the beginning of each fifth previous year back to 1825 and other selected years back to 1755; and also the coefficients M and N for approximate reductions with the formulae on page 50. The table is calculated from formulae derived from NEWCOMB'S numerical expressions for the precessional displacements of the mean equator, *Astr. Pap. Amer. Eph.*, Vol. VIII, page 75, 1897; M and N are obtained from the rates of change of $z + \zeta_0$ and θ at the time midway from t_0 to t . With the tabular constants, rigorous reductions of the coordinates α_0 , δ_0 , referred to the mean equinox of t_0 , to the coordinates α , δ , referred to the mean equinox of the beginning of the current year, may be calculated from the formulae

$$\begin{aligned}q &= \sin \theta [\tan \delta_0 + \cos (\alpha_0 + \zeta_0) \tan \tfrac{1}{2} \theta], \\ \tan (\Delta\alpha - \mu) &= \frac{q \sin (\alpha_0 + \zeta_0)}{1 - q \cos (\alpha_0 + \zeta_0)}, \\ \mu &= \zeta_0 + z, \\ \alpha &= \alpha_0 + \Delta\alpha, \\ \tan \tfrac{1}{2} (\delta - \delta_0) &= \tan \tfrac{1}{2} \theta \sec \tfrac{1}{2} (\Delta\alpha - \mu) \cos [(\alpha_0 + \zeta_0) + \tfrac{1}{2} (\Delta\alpha - \mu)].\end{aligned}$$

Eclipses (pages 299-305)

Elements and general circumstances are given for all solar and lunar eclipses, including penumbral lunar eclipses, which occur during the year. For solar eclipses, maps are given from which approximate local circumstances may be obtained for any particular place; and the Besselian elements are tabulated at 10-minute intervals for the calculation of accurate predictions for any point on or above the surface of the Earth. For total or annular eclipses the latitudes and longitudes of points on the central line and on the northern

and southern limits, together with the duration of the total or annular phase and the altitude of the Sun on the central line, are tabulated at intervals of five minutes or less throughout the eclipse. For lunar eclipses, the circumstances and their Ephemeris Times or Universal Times are the same for all parts of the Earth; any particular phase is visible from the hemisphere over which the Moon is then above the horizon.

The elements and circumstances are computed in accordance with BESSEL's method, for the International Ellipsoid, from apparent right ascensions and declinations of the Sun and Moon which include the short-period terms of nutation; and the coordinates of the Sun for this purpose are calculated to an additional decimal. The semidiameters of the Sun and Moon used in the calculation of eclipses do not include irradiation. The adopted semidiameter of the Sun at unit distance is $15' 59''.63$ (AUWERS, *Astronomische Nachrichten*, 3068, 367, 1891), the same, except for irradiation, as in the ephemeris of the Sun; but the apparent semidiameter of the Moon is calculated by putting its sine equal to $0.272274 \sin \pi$, where π is the horizontal parallax, and differs from the tabular value in the ephemeris of the Moon.

In the calculation of lunar eclipses, the radius of the geometric shadow of the Earth is increased by one-fiftieth part to allow for the effect of the atmosphere. Otherwise, refraction is neglected in computing solar and lunar eclipses. The Besselian elements do not involve refraction. The circumstances of eclipses are calculated for the surface of the ellipsoid, and the inclusion of refraction in them would be inappropriate. For local predictions, corrections for refraction are unnecessary; they are required only in precise comparisons of theory with observation, in which many other refinements are also necessary.

The magnitude of a solar eclipse is the fraction of the solar diameter obscured by the Moon at greatest phase, measured along the common diameter. The magnitude of a lunar eclipse is the fraction of the lunar diameter obscured by the shadow of the Earth at greatest phase, measured along the common diameter.

On the solar eclipse maps, the curves drawn in long dashes indicate the times halfway between first and last contacts of the penumbra. These times of the middle of the eclipse should not be confused with the times of greatest eclipse, from which they may differ by several minutes. The curves drawn in short dashes give the semiduration of the partial phase. The Ephemeris Times of first and last contacts are derived from the time of middle by respectively subtracting and adding the semiduration. The curves are extended across the rising and setting limits of the eclipse, although part of the phenomenon occurs below the horizon for observers in those regions.

The Besselian elements characterize the geometric position of the shadow of the Moon relative to the Earth. The exterior tangents to the surfaces of the Sun and the Moon form the umbral cone, the interior tangents the penumbral cone. The common axis of the two cones is the axis of the shadow. The geocentric plane perpendicular to the axis of the shadow is called the fundamental plane, and is taken as the xy -plane of a system of geocentric rectangular coordinates. The x -axis is the intersection of the fundamental plane with the

plane of the equator, and is directed positively toward the east; the y -axis is directed positively toward the north. The z -axis is parallel to the axis of the shadow, and is positive toward the Moon. The tabular x and y are the coordinates of the intersection of the axis of the shadow with the fundamental plane, in units of the equatorial radius of the Earth. The declination d and ephemeris hour angle μ of the point on the celestial sphere toward which the axis of the shadow is directed represent the direction of the axis.

The radius of the penumbral cone on the fundamental plane is denoted by l_1 ; the radius of the umbral cone is l_2 , and is regarded as positive for an annular eclipse, negative for a total eclipse. The angles f_1 and f_2 are the angles which the elements of the penumbral and the umbral cones, respectively, make with the axis of the shadow.

To predict accurate local circumstances, calculate the geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ from the geodetic latitude ϕ and longitude λ , with Table VII, page 465, and the formulae on page 497; the inclusion of the elevation above sea level in this calculation is all that is necessary to obtain the local circumstances at high altitudes or in the ionosphere. Obtain approximate times for the beginning, middle, and end of the eclipse from the eclipse map; and for each of these three times, take from the table of Besselian elements the values of x , y , $\sin d$, $\cos d$, μ , and l_1 , except that for the middle l_2 is needed instead of l_1 where the eclipse is total or annular. The hourly variations x' , y' , of x and y are needed, and may be obtained with sufficient accuracy by multiplying the first differences of the tabular values by 6.

For each of the three approximate times, calculate the coordinates ξ , η , ζ of the observer, and the hourly variations ξ' , η' , neglecting the variation of d , from

$$\begin{aligned}\xi &= \rho \cos \phi' \sin h, \\ \eta &= \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos h, \\ \zeta &= \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos h, \\ \xi' &= \mu' \rho \cos \phi' \cos h, \\ \eta' &= \mu' \xi \sin d,\end{aligned}$$

where

$$h = \mu - \lambda - 1.0027 \Delta T.$$

Next, calculate

$$\begin{aligned}u &= x - \xi, & u' &= x' - \xi', \\ v &= y - \eta, & v' &= y' - \eta', \\ L &= l - \zeta \tan f, & n^2 &= u'^2 + v'^2, & (n > 0) \\ \Delta &= \frac{1}{n} (uv' - u'v), & D &= uu' + vv',\end{aligned}$$

$$\sin \psi = \frac{\Delta}{L}.$$

Neglecting the variation of L , the correction τ to the assumed time of middle to obtain the *Ephemeris Time of greatest phase* is

$$\tau = -\frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

The correction τ to the assumed times of beginning, middle and end to obtain the *Ephemeris Times of contacts* is

$$\tau = \frac{L}{n} \cos \psi - \frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

The ambiguity in the quadrant of ψ is removed by noting that $\cos \psi$ must be negative for the beginning of the eclipse, for the beginning of the annular phase, and for the end of the total phase, and that $\cos \psi$ must be positive for the end of the eclipse, the end of the annular phase and the beginning of the total phase.

If the eclipse is partial at the place the quantities l_2 , L_2 and $\sin \psi$ will not be needed for the time of middle.

For greater accuracy, the times resulting from the calculation outlined above should be taken in place of the original approximate times, and a second approximation performed.

The adopted value of ΔT must be subtracted from the final times to obtain the Universal Times of contacts and greatest phase.

The *magnitude of greatest partial eclipse*, in units of the solar diameter, is

$$M_1 = \frac{L_1 - \Delta}{2L_1 - 0.5459},$$

where the absolute value of Δ is used.

The *magnitude of the central phase*, in the same units, is

$$M_2 = \frac{0.5459}{2L_1 - 0.5459}.$$

In order to obtain the *position angle of a point of contact*, calculate the angle N defined by

$$\cot N = \frac{v'}{u'},$$

$\sin N$ having the same algebraic sign as u' . The position angle P of the point of contact, reckoned from the north point of the solar limb toward the east, is

$$P = N + \psi,$$

where the results of the final approximation are used.

The position angle V of the point of contact, reckoned from the vertex of the solar limb toward the east is

$$V = P - C,$$

where C , the parallactic angle, is obtained with sufficient accuracy from

$$\tan C = \frac{\xi}{\eta},$$

$\sin C$ having the same algebraic sign as ξ , and the results of the final approximation again being used.

At any locality within several miles of a point for which the preceding computation has been made, the Ephemeris Times of the phases may be obtained by computing differential corrections in which most of the necessary numerical quantities are already available from the previous calculations.

Let

$$\begin{aligned} A_1 &= -\rho \cos \phi' \cos h, \\ B_1 &= -\xi \sin d, \\ A_2 &= -(SC^2 + H) \sin \phi \sin h, \\ B_2 &= (SC^2 + H) (\cos \phi \cos d + \sin \phi \sin d \cos h), \\ A_3 &= \cos \phi \sin h, \\ B_3 &= \sin \phi \cos d - \cos \phi \sin d \cos h. \end{aligned}$$

The Ephemeris Times of first and last contacts at longitude $\lambda + \Delta\lambda$, latitude $\phi + \Delta\phi$, elevation $H + \Delta H$, are obtained by adding to the exact times at the position λ, ϕ, H , the correction, in seconds,

$$T' = p\Delta\lambda + q\Delta\phi + r\Delta H,$$

where $\Delta\lambda$ and $\Delta\phi$ are in minutes of arc, ΔH is in units of the equatorial radius of the Earth and p, q, r are given by

$$\begin{aligned} p &= \frac{\sin 1'}{D} (uA_1 + vB_1), \\ q &= \frac{\sin 1'}{D} (uA_2 + vB_2), \\ r &= \frac{1}{D} (uA_3 + vB_3). \end{aligned}$$

The quantities p, q, r , are to be expressed in seconds by multiplying by 3600.

The Ephemeris Time of middle of central phase, or time of greatest eclipse if the eclipse is partial only, at $\lambda + \Delta\lambda, \phi + \Delta\phi, H + \Delta H$, is obtained by adding to the corresponding time T_m at λ, ϕ, H , the correction, in seconds,

$$T'_m = p_m\Delta\lambda + q_m\Delta\phi + r_m\Delta H,$$

where

$$\begin{aligned} p_m &= \frac{\sin 1'}{n^2} (u'A_1 + v'B_1), \\ q_m &= \frac{\sin 1'}{n^2} (u'A_2 + v'B_2), \\ r_m &= \frac{1}{n^2} (u'A_3 + v'B_3). \end{aligned}$$

These three quantities must be expressed in seconds by multiplying by 3600.

When the eclipse is total or annular at $\lambda + \Delta\lambda, \phi + \Delta\phi, H + \Delta H$, the Ephemeris Times of second and third contacts are

$$T_2 = T_m + T'_m - s, \quad T_3 = T_m + T'_m + s,$$

in which s is the semiduration of central phase. In order to compute s the value

of Δ in the final approximation of the time of middle at λ, ϕ, H , must receive the correction

$$\Delta' = p_s \Delta \lambda + q_s \Delta \phi + r_s \Delta H,$$

where

$$p_s = \frac{\sin 1'}{n} (u' B_1 - v' A_1),$$

$$q_s = \frac{\sin 1'}{n} (u' B_2 - v' A_2),$$

$$r_s = \frac{1}{n} (u' B_3 - v' A_3).$$

Then

$$\sin \psi_1 = \frac{1}{L_2} (\Delta + \Delta')$$

and

$$s = \pm \frac{L_2}{n} \cos \psi_1,$$

always taken as positive, and expressed in seconds by multiplying by 3600.

To obtain the angle C for second and third contacts at $\lambda + \Delta \lambda, \phi + \Delta \phi, H + \Delta H$, use the equation

$$\tan C = \frac{\xi \mp \xi' s}{\eta \mp \eta' s},$$

in which upper signs are for second contact, lower signs for third; ξ, η, ξ', η' are for the middle of the eclipse at λ, ϕ, H . In this equation s is to be expressed in hours; and $\sin C$ has the same algebraic sign as $(\xi \mp \xi' s)$.

The angles P and V are

$$\begin{aligned} P &= N + \psi_1, \\ P - C &= V, \end{aligned}$$

where N may be assumed constant in this instance; ψ_1 is obtained from the computation of s . In determining the quadrant of ψ_1 for the two contacts, note that in a total eclipse $\cos \psi_1$ is positive for second contact, negative for third, the reverse in an annular eclipse.

As before, the value of ΔT must be subtracted from the final Ephemeris Times in order to obtain the Universal Times.

In general, the *finally adopted value of ΔT* will differ somewhat from the value used in the predictions. It will not be necessary, however, to repeat the whole calculation for ϕ, λ, H . If the final value is equal to $\Delta T + \Delta' T$, it is sufficient to set

$$\Delta \lambda = 1.0027 \Delta' T, \quad \Delta \phi = 0, \quad \Delta H = 0,$$

and to compute T', T'_m and s as outlined above. It may be noted that only the quantities A_1, B_1, p, p_m and p_s will be required. The value $\Delta T + \Delta' T$ must be subtracted from the Ephemeris Times in order to obtain the Universal Times.

Differential corrections to the calculated times, for $\lambda + \Delta\lambda$, $\phi + \Delta\phi$, $H + \Delta H$.

	Beginning	Maximum	End
$\cos \phi \cos d$	+ 0.43049	+ 0.43049	+ 0.43049
$\sin \phi \sin d \cos h$	+ 0.01219	+ 0.01277	+ 0.01253
sum	+ 0.44268	+ 0.44326	+ 0.44302
$SC^2 + H$	1.00149	1.00149	1.00149
$\sin \phi \cos d$	+ 0.90248	+ 0.90248	+ 0.90248
$\cos \phi \sin d \cos h$	+ 0.00582	+ 0.00609	+ 0.00598
A_1	- 0.40160	- 0.42830	- 0.42836
B_1	+ 0.00230	+ 0.00077	- 0.00075
A_2	+ 0.33171	+ 0.11361	- 0.11257
B_2	+ 0.44334	+ 0.44392	+ 0.44368
A_3	- 0.15799	- 0.05411	+ 0.05362
B_3	+ 0.89666	+ 0.89639	+ 0.89650

	Beginning	End		Maximum
3600: D	- 20419	+ 20643	3600: n^2	19744
3600 $\sin 1': D$	- 5.9396	+ 6.0049	3600 $\sin 1': n^2$	5.7434
u	- 0.23574	+ 0.52049	u'	+ 0.39446
v	+ 0.50120	+ 0.18845	v'	- 0.16349
uA_1	+ 0.0947	- 0.2230	$u'A_1$	- 0.1689
vB_1	+ 0.0012	- 0.0001	$v'B_1$	- 0.0001
sum	+ 0.0959	- 0.2231	sum	- 0.1690
p	- 0.57	- 1.34	p_m	- 0.97
uA_2	- 0.0782	- 0.0586	$u'A_2$	+ 0.0448
vB_2	+ 0.2222	+ 0.0836	$v'B_2$	- 0.0726
sum	+ 0.1440	+ 0.0250	sum	- 0.0278
q	- 0.86	+ 0.15	q_m	- 0.16
uA_3	+ 0.0372	+ 0.0279	$u'A_3$	- 0.0213
vB_3	+ 0.4494	+ 0.1689	$v'B_3$	- 0.1466
sum	+ 0.4866	+ 0.1968	sum	- 0.1679
r	- 0.99 $\times 10^4$	+ 0.41 $\times 10^4$	r_m	- 0.33 $\times 10^4$

	h	m	s	s	s	s
U.T. of first contact	21	28	41.4	- 0.57 $\Delta\lambda$	- 0.86 $\Delta\phi$	- 0.99 $\times 10^4\Delta H$
U.T. of maximum eclipse	22	25	54.1	- 0.97 $\Delta\lambda$	- 0.16 $\Delta\phi$	- 0.33 $\times 10^4\Delta H$
U.T. of last contact	23	23	22.9	- 1.34 $\Delta\lambda$	+ 0.15 $\Delta\phi$	+ 0.41 $\times 10^4\Delta H$

Corrected times at Nome, Alaska, for a modified value of ΔT :

Let it be assumed that the observed value of ΔT is + 35 seconds, instead of + 36 seconds as adopted in the predictions.

With the values of p and p_m obtained above, the corrected times are found as follows:

	Beginning	End		Maximum
$\Delta' T$	- 1.0	- 1.0	$\Delta' T$	- 1.0
$\Delta\lambda$	- 0.251	- 0.251	$\Delta\lambda$	- 0.251
p	- 0.57	- 1.34	p_m	- 0.97
$p\Delta\lambda$	+ 0.14	+ 0.34	$p_m\Delta\lambda$	+ 0.24
$p\Delta\lambda - \Delta' T$	+ 1.14	+ 1.34	$p_m\Delta\lambda - \Delta' T$	+ 1.24

	h	m	s	h	m	s		h	m	s
predicted U.T.	21	28	41.4	23	23	22.9	predicted U.T.	22	25	54.1
corrected U.T.	21	28	42.5	23	23	24.2	corrected U.T.	22	25	55.3

Ephemerides for Physical Observations

The ephemerides for physical observations of the Sun, Moon, and planets are based on the fundamental ephemerides in the preceding part of the volume, and on the additional data to which specific references are made. The tabular values are affected by aberration, and should therefore be interpolated to the actual time of observation; but they are strictly geocentric. They are given to a degree of accuracy sufficient for the reduction of observations, and any significant approximations made in their calculation are stated.

The value of the light-time for unit distance used in calculating the physical ephemerides is 498^s·58, corresponding to the adopted values of the solar parallax and velocity of light. The stellar magnitudes of the planets are obtained from the formulae of G. MÜLLER, *Publicationen des Astrophysikalischen Observatoriums zu Potsdam*, 8, 366, 1893; the diameters of the planets are calculated from the same semidiameters at unit distance as in the fundamental ephemerides.

Ephemeris for Physical Observations of the Sun (pages 310–315)

This ephemeris is calculated from the elements determined by CARRINGTON, *Observations of the Spots on the Sun*, pages 221, 244, 1863:

Inclination of the solar equator to the ecliptic, $7^{\circ} 15'$;

Longitude of the ascending node of the solar equator on the ecliptic,
 $73^{\circ} 40' + 50'' \cdot 25 t$, where t is the time in years reckoned from 1850;

Sidereal period of rotation, 25.38 mean solar days.

In the ephemeris, P denotes the position angle of the northern extremity of the axis of rotation, measured eastward from the north point of the disk; B_0 , the heliographic latitude, and L_0 , the heliographic longitude, of the central point of the disk. Heliographic longitudes on the surface of the Sun are measured from the solar meridian that passed through the ascending node of the solar equator on the ecliptic on 1854 January 1, Greenwich mean noon (J. D. 239 8220.0); they are reckoned from 0° to 360° , in the direction of rotation, i. e., westward on the apparent disk as viewed on the celestial sphere. CARRINGTON'S zero meridian passed the ascending node twelve hours earlier.

The synodic period of rotation is the interval of time during which L_0 decreases by 360° . The mean synodic period is 27^d·2753. The beginning of each synodic rotation is the instant at which L_0 passes through 0° ; the rotations are numbered in continuation of CARRINGTON'S Greenwich photo-heliographic series, of which No. 1 commenced on 1853 November 9.

In computing the physical ephemeris of the Sun, no allowance for the secular motion of the ecliptic is made in the values of the elements; and the latitude of the Sun is neglected. No correction is applied to L_0 for rotation during the light-time, since presumably it is already included in CARRINGTON'S meridian; CARRINGTON, in reducing his observations, added $20''$ for aberration to the tabular longitude of the Sun taken from the *Nautical Almanac*, but he appears to have referred his measurements to the *apparent* central point of the disk. By using the apparent longitude of the Sun in calculating the physical ephem-

eris, the aberration in longitude is included; and no further correction for aberration is required. For convenience of calculation, however, it has been the practice to use formulae which only partially take account of the aberration in longitude, since the error introduced into P and B_0 is inappreciable, and the error in L_0 , though at maximum it can amount to about $20''$, has not been considered important.

Ephemeris for Physical Observations of the Moon (pages 316-325)

In the computation of this ephemeris, the formulae and constants for the physical librations, and the value $1^\circ 32'.1$ for the inclination of the mean lunar equator to the ecliptic, that were determined by HAYN, *Abh. d. Math.-phys. Kl. d. K. Sächs. Ges. d. Wiss.*, XXX, page 49, 1907, have been used. The ephemeris is calculated from the apparent coordinates of the Moon and the Sun, and therefore aberration is fully included, excepting the inappreciable difference between the light-time from the Sun to the Moon and from the Sun to the Earth.

The *Age* is the number of days elapsed since the previous New Moon. The *Fraction Illuminated* is the fraction of the area of the lunar disk that is illuminated, and is equal to the illuminated fraction of the diameter perpendicular to the line of cusps.

On the surface of the Moon, selenographic longitudes are measured from the lunar meridian that passes through the mean central point of the visible disk, positive in the direction toward *Mare Crisium*, i. e., toward the west on the celestial sphere. Selenographic latitudes are reckoned positive towards the north limb; that is, they are positive in the hemisphere containing *Mare Serenitatis*. The mean central point of the disk is defined as the point on the lunar surface where the surface is intersected by the radius of the Moon that would be directed toward the center of the Earth, were the Moon to be at the mean ascending node when the node coincided with either the mean perigee or mean apogee.

The tabular selenographic longitude and latitude of the Earth are the geocentric selenographic coordinates of the apparent central point of the disk; at this point on the surface of the Moon, the Earth is in the selenocentric zenith. These coordinates are the sums of the geocentric optical and physical librations in longitude and latitude respectively. When the libration in longitude, that is the selenographic longitude of the Earth, is positive, the mean central point of the disk is displaced eastward on the celestial sphere, exposing to view a region on the west limb. When the libration in latitude, or selenographic latitude of the Earth, is positive, the mean central point of the disk is displaced towards the south, and a region on the north limb is exposed to view.

The selenographic coordinates of the point on the lunar surface where the Sun is in the selenocentric zenith are the selenographic longitude and latitude of the Sun. Subtracting the selenographic longitude of the Sun from 90° or 450° gives the selenographic *colongitude* of the Sun tabulated in the ephemeris; numerically, it is the *east* selenographic longitude of the morning terminator, and is therefore approximately 270° , 0° , 90° , and 180° at New Moon, First

Quarter, Full Moon and Last Quarter, respectively. The longitude of the evening terminator differs by 180° from that of the morning terminator.

The position angle of the axis is the angle that the lunar meridian through the apparent central point of the disk towards the north lunar pole forms with the declination circle through the central point, reckoned eastward from the north point of the disk.

The column headed *Position Angle—Bright Limb* contains the position angles of the midpoint of the illuminated limb, reckoned eastward from the north point of the disk. They replace the values which before 1960 were given for the position angle of the terminator, defined as the position angle of the northern cusp, or angle that the line of cusps forms with the declination circle through the apparent central point of the disk. The position angle of the terminator always lies between -90° and $+90^\circ$; before Full Moon it is 90° greater, after Full Moon 90° less, than the position angle of the midpoint of the bright limb.

For accurate reductions of observations, the tabular librations and position angles of the axis should be reduced to topocentric values. The topocentric values may be obtained by means of differential corrections, for which formulae are given by ATKINSON, *Mon. Not. Roy. Astr. Soc.*, **111**, 448, 1951; or, alternatively, the topocentric optical librations may be obtained by direct calculation, and the tabular geocentric physical librations used without correction. The optical librations l' in longitude and b' in latitude may be calculated from the apparent topocentric longitude λ and latitude β of the Moon by the formulae

$$\begin{aligned} l' &= \lambda + \mu + Ab' - \mathfrak{C}, \\ b' &= B - \beta, \end{aligned}$$

in which μ , A , B , are tabulated on pages 324–325 with argument $\lambda - \Omega$, and Ω and \mathfrak{C} are tabulated on page 51; the topocentric values of λ and β are obtained by applying corrections for geocentric parallax to the apparent geocentric co-ordinates of the Moon. The position angle C' of the axis, affected by only optical libration, is determined by

$$\sin C' = \sin i \cos (l' + \Delta + \mathfrak{C} - \Omega) \sec \delta,$$

where δ is the topocentric declination, and i and Δ are tabulated on page 51; adding the tabular physical libration gives the topocentric position angle.

Disks of Mercury and Venus (pages 326–327)

Beginning with 1960, the position angle Θ of the midpoint of the bright limb is tabulated instead of the position angle θ of the line of cusps formerly given in these ephemerides. The angle Θ is the position angle of the arc of the great circle from the planet to the Sun, while θ is the angle which this arc forms with a great circle passing through the planet and directed toward the west. The angle θ is measured from the westward directed great circle, through north, east, and south, from 0° to 360° . Therefore $\Theta = \theta - 90^\circ$; the position angle of the greatest defect of illumination is $\Theta + 180^\circ = \theta + 90^\circ$.

Ephemerides for Physical Observations of Mars, Jupiter, and Saturn
(pages 328-341)

These ephemerides give the time required for light to travel from the planet to the Earth, and the stellar magnitude and apparent diameter of the planet; and for the illuminated disk they give the position angle of the point of greatest defect of illumination, measured eastward from the north point of the disk, and the angular amount of the defect; the planetocentric angle i between the Sun and the Earth is also tabulated. In the ephemeris for Mars, the ratio k of the area of the illuminated apparent disk to the area of the entire apparent disk regarded as circular is included.

For Mars and Jupiter, quantities are given which determine the geocentric and heliocentric aspects of the planetographic coordinate systems on the surface of the planet, to which the markings on the disk are referred. The aspect of the disk depends upon the positions of the Earth and the Sun relative to the different areas of the surface of the planet, or equivalently upon the apparent positions of the Earth and the Sun on the planetocentric celestial sphere at the different points of the surface. To represent these positions, coordinate systems are defined on the planetocentric sphere, by the plane of the equator of the planet and the plane of its orbit, in the same way as right ascension and declination, and celestial longitude and latitude, are defined on the geocentric celestial sphere by the equator of the Earth and the ecliptic. Because of the mathematically indefinite radius of the celestial sphere, the same fundamental reference circles are defined on the geocentric sphere as on the planetocentric sphere by the orbital and equatorial planes of the Earth and the other planets.

On a planetocentric sphere, the apparent position of the Earth is diametrically opposite the geocentric position of the planet, and the Sun is opposite the heliocentric position. The planetocentric angular distance of the Earth from the equator of the planet, denoted by D_E and known as the planetocentric declination of the Earth, is numerically equal and opposite in sign to the geocentric angular distance of the planet from the plane of the equator of the planet. The ascending node of the orbit of the planet on its equator is the vernal equinox of the planet; the angular distance in the plane of the planetary equator from this point eastward to the great circle through the Earth and the celestial pole of the planet, denoted by A_E , is known as the planetocentric right ascension of the Earth, and is equal to the geocentric longitude of the planet measured in the plane of its equator from its autumnal equinox or descending node of its orbit on its equator. Similarly, the planetocentric right ascension of the Sun, A_S , is equal to the heliocentric longitude of the planet measured in the plane of its equator from its autumnal equinox; and the planetocentric declination of the Sun, D_S , is numerically equal and opposite in sign to the heliocentric angular distance of the planet from the plane of the planetary equator. The planetocentric longitude of the Sun, denoted by L_S and measured in the plane of the orbit of the planet from its vernal equinox, is equal to the heliocentric orbital longitude of the planet reckoned from its autumnal equinox; it is tabulated only for Mars.

Planetographic longitudes on the surfaces of Mars and Jupiter are reckoned from 0° to 360° in the direction opposite the rotation, that is, eastward on the celestial sphere. The zero meridian from which the longitudes are measured is defined by the adopted position of the pole and an adopted value for the longitude of the meridian that passes through the central point of the disk at a selected epoch. The adopted longitude of the central meridian at the epoch and the rate of rotation of the planet determine the central meridian at any other time. The rotation is referred to the ascending node of the orbit on the equator of the planet, and the period is therefore known as the sidereal period of rotation; it differs slightly from the actual period of rotation, because of the precession of the axis of the planet.

For Mars, the position of the north pole that is used in computing the physical ephemeris was adopted in 1909, and the zero meridian is defined by the tabular central meridian at Greenwich mean noon on 1909 January 15; but beginning with 1960, a period of rotation is adopted that differs from the value used before 1960. Consequently, from 1959 to 1960 there is a discontinuity in the tabular longitude of the central meridian, amounting to about -1° . The adopted rotation elements of Mars are:

North pole of Mars (LOWELL and CROMMELIN, *M. N. R. A. S.* **66**, 56, 1905)
At the beginning of the year t ,

$$\begin{aligned}\alpha_0 &= 21^{\text{h}} 11^{\text{m}} 10^{\text{s}}.42 + 1^{\text{s}}.565 (t - 1950.0), \\ \delta_0 &= +54^\circ 39' 27'' + 12''.60 (t - 1950.0).\end{aligned}$$

Sidereal period of rotation (ASHBROOK, *Astr. Jour.*, **58**, 145, 1953)

In Ephemeris Time, $24^{\text{h}} 37^{\text{m}} 22^{\text{s}}.6689$.

Central meridian, referred to the zero meridian of 1909

Longitude of central meridian,

1909 Jan. 15, G.M.N. (J.D. 241 8322.0), $344^\circ.41$.

Daily motion, $350^\circ.891\ 962$.

The tabular central meridian is for the geometric disk, not the illuminated disk; and the time of transit of the zero meridian is for the transit across the central point of the geometric disk.

The position angle of the axis is the angle which the meridian from the central point of the disk to the north pole of rotation forms with the declination circle through the central point, measured eastward from the north point of the disk.

For Jupiter, the adopted position of the pole is derived from the position for 1750 given by DAMOISEAU, *Tables Écliptiques des Satellites de Jupiter* (Paris, 1836), page i; the longitude of the central meridian that defines the zero meridian, and the rate of rotation, are adopted from the ephemeris last published by MARTH, *Mon. Not. Roy. Astr. Soc.*, **56**, 523, 1896:

North Pole of Jupiter

At the beginning of the year t ,

$$\alpha_0 = 17^{\text{h}} 52^{\text{m}} 00^{\text{s}}.84 + 0^{\text{s}}.247 (t - 1910.0),$$

$$\delta_0 = +64^{\circ} 33' 34''.6 - 0''.60 (t - 1910.0).$$

	System I	System II
<i>Sidereal period of rotation</i>	9 ^h 50 ^m 30 ^s .003	9 ^h 55 ^m 40 ^s .632
<i>Central meridian</i>		
Longitude,		
1897 July 14, G. M. N. (J.D. 241 4120.0)	47°31	96°58
Daily motion	877°90	870°27

System I applies to all points on or between the north component of the south equatorial belt and the south component of the north equatorial belt; System II applies north of the south component of the north equatorial belt, and south of the north component of the south equatorial belt.

The tabular central meridians are for the geometric disk; applying to them the corrections in the column headed *Correction for Phase* gives the longitudes of the central meridian of the apparent or illuminated disk. In addition, the longitude of the central meridian of the illuminated disk is tabulated at daily intervals in a separate ephemeris; the tables of the motion of the central meridian accompanying this ephemeris are based on the mean daily synodic rotations during the period when Jupiter is observable, which are 877°95 for System I, and 870°30 for System II. An accuracy of 0°1 for the central meridian of the illuminated disk is usually sufficient, and may readily be obtained from the daily ephemeris; interpolation in the 4-day ephemeris is less convenient, but may be made in the infrequent cases when an accuracy of 0°01 is needed.

Satellites

The ephemerides of the satellites are intended only for search and identification, not for the exact comparison of theory with observation; they are calculated only to an order of accuracy sufficient for the purpose of facilitating observations. They are corrected for light-time; the tabular values are directly comparable with observations at the tabular times. The value of the light-time used in calculating the ephemerides of the satellites is 498^s.58 for unit distance.

The apparent orbit of a satellite is an ellipse on the celestial sphere, with semimajor axis a/Δ , where a is the apparent semimajor axis at unit distance in seconds of arc and Δ is the geocentric distance of the primary. In the tables for finding the position angle p of the satellite relative to the primary, measured in the usual way from north toward east, and the apparent distance s from the central point of the disk of the primary, the factor F is the ratio of s to the apparent distance at greatest elongation, and therefore $s = F \frac{a}{\Delta}$. At the greatest elongations, $p = P \pm 90^\circ$, where P is the position angle of the extremity of the *minor* axis of the apparent orbit that is directed toward the pole of the orbit from which the motion appears counterclockwise. With P_0 denoting an arbi-

trary fixed integral number of degrees near the value of P at opposition, the value of p at any time is expressed in the form $p_1 + p_2$, where p_1 is the sum of the approximate position angle $P_0 + 90^\circ$ at elongation and the amount of motion in position angle since elongation, and p_2 denotes the correction $P - P_0$. In the tables of p_1 the tabular entry for argument 0^h00^m is the value of $P_0 + 90^\circ$. In calculating F and p_1 , the value of the eccentricity of the apparent orbit at opposition is used; and consequently in the values of s and p which are derived from them, the effect of the variation of the eccentricity of the apparent orbit is neglected.

The differences of right ascension and declination, in the sense "satellite minus primary", are approximately

$$\Delta\alpha = s \sin p \sec(\delta + \Delta\delta), \quad \Delta\delta = s \cos p,$$

in which $s \sin p$ and $s \cos p$ are the rectangular coordinates of the satellite in the directions perpendicular to the circle of declination and along this circle, respectively.

Satellites of Mars (pages 342-345)

The ephemerides of the satellites of Mars are computed from the orbital elements given by H. STRUVE, *Sitzungsberichte der Königl. Preuss. Akademie der Wissenschaften*, 1911, page 1073.

Satellites of Jupiter (pages 346-373)

The ephemerides of Satellites I-IV are based on SAMPSON'S *Tables of the Four Great Satellites of Jupiter*, London, 1910; but they are computed in accordance with the procedures developed by H. ANDOYER, *Bulletin Astronomique*, **32**, 177, 1915, in which a number of approximations and modifications of the tabular procedures are made.

Beginning with 1960, the elongations of Satellite V are computed from circular orbital elements determined by A. J. J. VAN WOERKOM, *Astr. Pap. Amer. Eph.*, vol. XIII, Part I, 1950:

Epoch $T_0 = 1903$ September 1.5 U.T. = J.D. 241 6359.0

Mean elongation at unit distance	249°55
Inclination to equator of Jupiter	24'1
Longitude of ascending node	82°5 - 914°62 ($T - T_0$)
Mean motion per mean solar day	722°63175 = 2°0073 10417
Mean longitude at epoch	194°98
Secular acceleration	$-0^\circ113 - 0^\circ0076 (T - T_0) + 0^\circ00035 (T - T_0)^2$

where $T - T_0$ is reckoned in Julian years, and the longitudes are reckoned in the plane of the equator of Jupiter, from the ascending node of the mean orbital plane of Jupiter on the plane of the equator of Jupiter, as in the physical ephemeris.

The differential coordinates of Satellites VI and VII are computed from J. BOBONE'S tables, *Astronomische Nachrichten*, 6279, 321, 1937, and 6309, 401, 1937.

The configurations of Satellites I–IV are shown in graphical form, on pages facing the tabular ephemerides of the eclipses and other phenomena of the satellites. The central vertical band in each diagram represents the equatorial diameter of the disk of Jupiter; the relative positions of the satellites at any time with respect to the disk of Jupiter are given by the curves. Where a satellite is immersed in the shadow of Jupiter or occulted behind the disk, the curve is interrupted. In constructing these diagrams, the coordinates of the satellites in the direction perpendicular to the equator of Jupiter are necessarily neglected.

For eclipses, the points d of immersion into the shadow and points r of emersion from the shadow are shown pictorially at the foot of the right-hand page, for the middle of each month; and at the foot of the left-hand page the rectangular coordinates of these points are given, in units of the equatorial radius of Jupiter. The axis of x is parallel to the equator of Jupiter, positive toward the east, and the axis of y is positive toward the north pole of Jupiter. The suffix 1 refers to the beginning of an eclipse, the suffix 2 to the end of an eclipse.

Satellites and Rings of Saturn (pages 374–389)

The ephemeris of the rings of Saturn is computed from the elements of the plane of the rings determined by G. STRUVE, *Veröff. d. Universitätssternwarte zu Berlin-Babelsberg*, VI, 4, page 49, 1930. The apparent outer dimensions of the outer ring are according to H. STRUVE, *Pub. de l'Obs. Central Nicolas*, XI, page 226, 1898; the factors for computing the relative dimensions of the rings are from BESSEL, *Abhandlungen*, I, pp. 110, 150, 319, except those for the dusky ring which are based on the observations of various astronomers.

The ephemeris of the rings gives the quantities that determine the Saturnian positions of the Earth and the Sun referred to the plane of the rings, upon which the appearance of the rings depends; the tabular quantities are:

- U , the geocentric longitude of Saturn, measured in the plane of the rings eastward from its ascending node on the mean equator of the Earth; the Saturnian longitude of the Earth, measured in the same way, is $U+180^\circ$.
- B , the Saturnian latitude of the Earth referred to the plane of the rings, positive toward the north; when B is positive, the visible surface of the rings is the northern surface.
- P , the geocentric position angle of the northern semiminor axis of the apparent ellipse of the rings, measured from north toward east.
- U' , the heliocentric longitude of Saturn, measured in the plane of the rings eastward from its ascending node on the ecliptic; the Saturnian longitude of the Sun, measured in the same way, is $U'+180^\circ$.
- B' , the Saturnian latitude of the Sun referred to the plane of the rings, positive toward the north; when B' is positive, the northern surface of the rings is the illuminated surface.
- P' , the heliocentric position angle of the northern semiminor axis of the rings on the heliocentric celestial sphere, measured eastward from the circle of latitude through Saturn.

The ephemeris of the rings is not corrected for light-time; for comparison with observation, the light-time tabulated in the physical ephemeris must either be added to the tabular time or subtracted from the time of observation.

The ephemerides of the six inner satellites and of Iapetus are computed from the orbital elements determined by G. STRUVE, *Veröff. d. Universitätssternwarte zu Berlin-Babelsberg*, VI, Parts 4 (1930) and 5 (1933). The ephemeris of Hyperion is computed from the elements given by J. WOLTJER, Jr., *Annalen van de Sterrewacht te Leiden*, XVI, Part 3, page 64, 1928; and of Phoebe, from the theory by F. E. ROSS, *Annals of Harvard College Observatory*, LIII, Number VI, 1905.

For the eight inner satellites, the times of conjunctions and elongations, and tables for finding the approximate apparent distance s and position angle p , are given. On the diagram of the orbits of Satellites I–VII, the points of eastern elongation are marked as “0”; and from the tabular times of these elongations, the apparent position of a satellite at any other time may be marked on the diagram by setting off on the orbit the elapsed interval since last eastern elongation. For Hyperion and Iapetus, ephemerides of the differential coordinates are also included; and an ephemeris of differential coordinates is given for Phoebe.

In calculating the elongations and conjunctions, and the tables of apparent distance and position angle, solar perturbations are not included for any of the eight satellites; and for the five innermost satellites, the orbital eccentricity e and the inclination γ to the plane of the rings are neglected. However, the mean longitude L and mean anomaly M , calculated from accurate values of the orbital elements, and including for Titan the solar perturbations, are tabulated at 10-day intervals for the eight inner satellites, and with them are given the values of the elements that have large variations. From the orbital position of the satellite determined with these tabular values, and the Saturnicentric position of the Earth referred to the orbital plane of the satellite, values for the apparent distance and position angle may be calculated, and differential coordinates in right ascension and declination determined. For Titan, Hyperion, and Iapetus, ephemerides are given for the values of U , B , and P defined and measured relative to the orbital plane in the same way as the values relative to the plane of the rings; and for Satellites I–VI, tables of F with argument $u-U$ are included, where u is the orbital longitude of the satellite. The tabular values of L and M , and of U , B , P , are the actual values at the tabular times, not corrected for light-time.

The mean orbital longitude L and the true longitude u of the satellite, and the longitude θ of the ascending node of the orbit on the plane of the rings, are measured from the ascending node of the ring-plane on the mean equator of the Earth; L and u are reckoned along the ring-plane to the node of the orbit, then along the orbit. The formulae and constants for obtaining the true orbital longitude u and the radius vector r of each satellite in 1960, and from them the apparent geocentric position relative to Saturn, are:

Mimas

$$u = L + 2^{\circ}303 \sin M + 0^{\circ}029 \sin 2M,$$

$$\frac{r}{a} = 1.0002 - 0.0201 \cos M - 0.0002 \cos 2M,$$

$$a = 255''.9, \quad \sin \gamma = 0.0265.$$

Enceladus

$$u = L + 0^{\circ}509 \sin M; \text{ the motion of } L \text{ in } 10^d \text{ varies from } 2627^{\circ}311 \text{ to } 2627^{\circ}322,$$

$$\frac{r}{a} = 1 - 0.0044 \cos M,$$

$$u - \theta = 36^{\circ} + 263^{\circ}.15 \text{ (J.D.} - 243 \text{ 6000.5),}$$

$$a = 328''.3, \quad \sin \gamma = 0.0004.$$

Tethys

$$u = L, \quad \frac{r}{a} = 1,$$

$$a = 406''.4, \quad \sin \gamma = 0.0191.$$

Dione

$$u = L + 0^{\circ}253 \sin M,$$

$$\frac{r}{a} = 1 - 0.0022 \cos M,$$

$$u - \theta = 214^{\circ} + 131^{\circ}.62 \text{ (J.D.} - 243 \text{ 6000.5),}$$

$$a = 520''.5, \quad \sin \gamma = 0.0004.$$

Rhea (at opposition of Saturn)

$$e = 0.00118, \quad a = 726''.9,$$

$$u = L + 0^{\circ}135 \sin M,$$

$$\frac{r}{a} = 1 - 0.00118 \cos M.$$

Titan (at opposition of Saturn)

$$e = 0.02895, \quad a = 1684''.4,$$

$$u = L + 3^{\circ}317 \sin M + 0^{\circ}060 \sin 2M,$$

$$\frac{r}{a} = 1.00042 - 0.02895 \cos M - 0.00042 \cos 2M,$$

$$F = 1 - \frac{0.00817}{\Delta} \frac{r}{a} \cos (u - U).$$

The apparent rectangular coordinates referred to Saturnicentric axes, with the x -axis in the plane of the rings and positive toward the east, the y -axis positive toward the north pole of Saturn, are

$$x = \frac{a}{\Delta} \frac{r}{a} F \sin (u - U)$$

$$= s \sin (p - P),$$

$$y = \frac{a}{\Delta} \frac{r}{a} F \left[\sin B \cos (u - U) + \cos B \sin \gamma \sin (u - \theta) \right]$$

$$= s \cos (p - P),$$

from which s and p may be determined, or $\Delta\alpha$ and $\Delta\delta$.

Satellites of Uranus (pages 390-392)

The ephemerides of Ariel and Umbriel are computed from the orbital elements determined by NEWCOMB, *Washington Obs. for 1873*, App. I; of Titania and Oberon, from the elements by H. STRUVE, *Abh. d. K. Preuss. Akad. d. Wiss.*, 1912. STRUVE's elements of the plane of the orbits are adopted for all four satellites.

Satellites of Neptune (page 393)

The ephemeris of Triton is calculated from elements by W. S. EICHELBERGER and ARTHUR NEWTON, *Astr. Pap. Amer. Eph.*, vol. IX, Part III, 1926.

Sunrise, Sunset, and Twilight (pages 394-401)

The tabular times of sunrise and sunset are the instants when the true geocentric zenith distance of the central point of the disk is $90^{\circ} 50'$. With an adopted value of $34'$ for the horizontal refraction, and $16'$ for the semidiameter, the apparent zenith distance of the upper limb, neglecting parallax, is then 90° , and the limb is apparently on the astronomical horizon. The tabular times of the beginning and end of astronomical twilight are the instants when the true geocentric zenith distance of the central point of the disk is 108° .

The tabular values give the local mean times of the phenomena on the meridian of Greenwich for northern latitudes up to $+60^{\circ}$. No interpolation is usually made for the local times at other longitudes; the error from neglecting the variation with longitude is negligible, amounting to a maximum of 2^m in latitude 60° North. To obtain the local *standard* time or zone time, increase the local time four minutes for each degree of longitude west of the standard meridian, or decrease the local time four minutes for each degree east of the standard meridian.

In a *southern* latitude, the time of sunrise, sunset, or beginning or end of twilight, is obtained for any date by entering the table with the same *numerical value* of the latitude, but for a date about six months earlier or later than the actual date, and applying a small correction to the tabular time; these dates and corrections are tabulated at the foot of the page. The periods during which twilight lasts all night in southern latitudes may be found by substituting for the northern latitudes the corresponding southern latitudes, and for the dates the corresponding dates taken from the foot of the page.

Example

On 1960 May 4, in latitude -38° , required the times of sunrise, sunset, and beginning and end of twilight. November 6 is the corresponding date, northern latitude, and the correction is $+13^m$.

	Beginning of Twilight		Sunrise		Sunset		End of Twilight	
	h	m	h	m	h	m	h	m
Lat. $+38^{\circ}$, Nov. 6	5	00	6	31	16	56	18	25
Auxiliary table	+13		+13		+13		+13	
<hr/>								
Lat. -38° , Local mean time, May 4 . .	5	13	6	44	17	09	18	38

The tabular values are based on the "Tables of Sunrise, Sunset, and Twilight" published as a *Supplement to the American Ephemeris for 1946*. These tables provide for obtaining the times at any point on the Earth in any year of the twentieth century.

Moonrise and Moonset (*pages 402-433*)

The tabular times of moonrise and moonset are the instants when the true geocentric zenith distance of the central point of the disk is $90^{\circ} 34' + S - \pi$, where S is the semidiameter and π the horizontal parallax of the Moon, and $34'$ is the adopted horizontal refraction; the upper limb is then apparently on the astronomical horizon.

The tabular times are for the meridian of Greenwich, and are given both for northern and for southern latitudes from $+60^{\circ}$ to -60° . To obtain the local mean time of moonrise or moonset at other longitudes that are 12 hours or less west from Greenwich, take out the tabular times for the given date and for the next following date; at longitudes 12 hours or less east from Greenwich, take out the times for the given date and for the date preceding. Subtract the time on the earlier date from the time on the later date; multiply the difference by the twenty-fourth part of the longitude in hours and decimals of an hour, positive if west, negative if east; apply the product as a correction to the tabular time on the given date to obtain the required local mean time. To obtain the standard time or zone time, increase the local time by four minutes for each degree of longitude west of the standard meridian, or decrease the local time by four minutes for each degree east of the standard meridian.

Examples

1. For 1960 January 2, find the standard time of moonrise and moonset at longitude 145° or $9^{\text{h}} 40^{\text{m}}$ east from Greenwich (20^{m} west of the standard meridian) and latitude $37^{\circ} 50'$ south.

	d	Moonrise		Moonset	
		h	m	h	m
For Lat. $-37^{\circ}8$	Jan. 1	7	45	21	30
	Jan. 2	8	51	22	09
Difference		+66		+39	
Product of diff. by $-9.7/24$		-26		-16	
Local mean time.	Jan. 2	8	25	21	53
Reduction to standard time.		+20		+20	
Standard time.	Jan. 2	8	45	22	13

2. For 1960 July 10, find the Eastern Standard Time of moonrise and moonset at Washington, D. C., longitude 77° or $5^{\text{h}} 08^{\text{m}}$ west, latitude $38^{\circ} 55'$ north.

	d	Moonrise		Moonset	
		h	m	h	m
For Lat. $+38^{\circ}9$	July 10	20	46	6	37
	July 11	21	29	7	48
Difference		+43		+71	
Product of diff. by $+5.1/24$		+9		+15	
Local mean time.	July 10	20	55	6	52
Reduction to standard time.		+8		+8	
Eastern Standard Time	July 10	21	03	7	00

Astronomical Observatories (*pages 434-452*)

The list of optical observatories is followed by a list of radio observatories; and an *Index List* is given for finding observatories that are better known by special names than by their geographic location.

The latitudes in most cases are astronomical; but in some instances they have been determined by geodetic triangulation from other points. The geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ are calculated for the International Ellipsoid; the altitude is included in every case where it is known.

The last two columns on the right-hand pages contain the parallax constants

$$\begin{aligned}\Delta_{\alpha} &= -\rho \cos \phi' \sin 8''.80 \\ &= -426.64 \rho \cos \phi' \times 10^{-7}, \\ \Delta Z &= -\rho \sin \phi' \sin 8''.80 \\ &= -426.64 \rho \sin \phi' \times 10^{-7};\end{aligned}$$

the tabular values are in units of the seventh decimal. Formulae for parallax corrections in right ascension and declination, and for corrections to the equatorial rectangular coordinates of the Sun to eliminate parallax, are given at the foot of each righthand page.

Tables (*pages 453-481*)

A list of the individual tables is given in the *Contents*. With the exception of Table II, reference has been made to each of these tables in the foregoing descriptions of the ephemerides, and an explanation of the table given where it is not self explanatory.

Table I of Julian Day Numbers is explained in the section on the calendar.

Table II, for determining latitude and azimuth from observations of Polaris, includes the precepts for the use of the table at the foot of each page.

Table III, for the reduction of mean places from one epoch to another, is explained in the section on mean places of stars. Tables IV-VI relating to reductions for precession, nutation, and differential aberration, include precepts for their use, and are referred to in the section on Day Numbers.

The precepts for using Table VII to calculate geocentric coordinates are included with the formulae for the International Ellipsoid in the section on units and constants.

Tables VIII-XII for conversions of measures of time, and the Interpolation Tables XIII-XVII are self explanatory.

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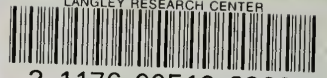
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